Smithsonian

October 1986

A flower's inner secrets

Radiographs, like these of cyclamens, reveal unseen beauty of blossoms (p. 88)

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Smithsonian

Volume 17, Number 7

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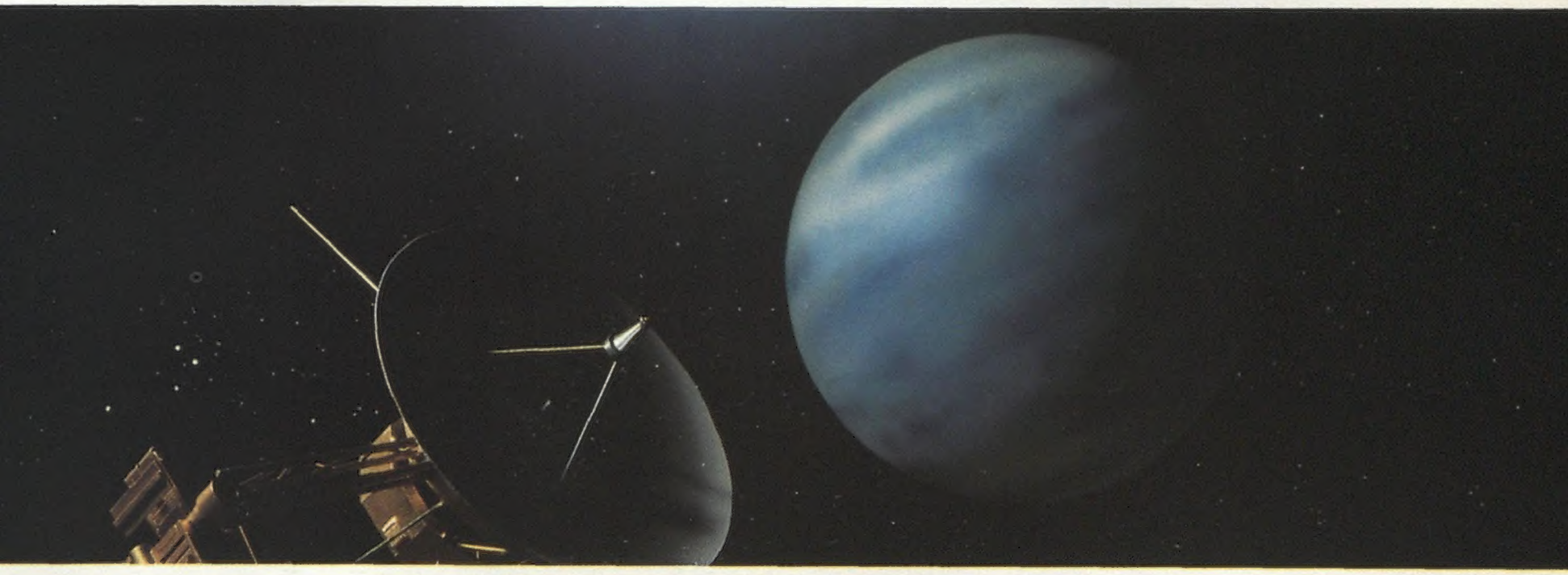

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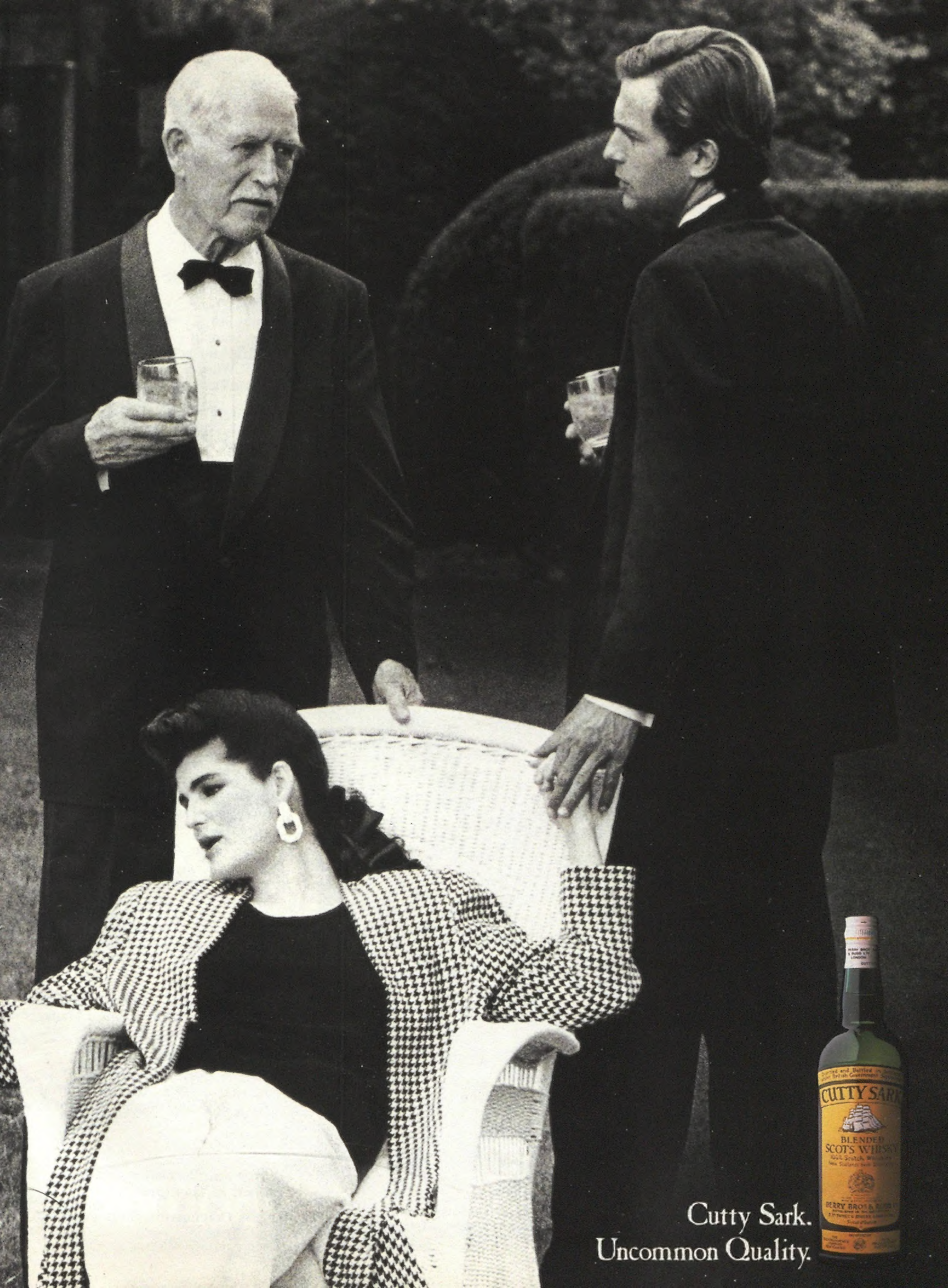

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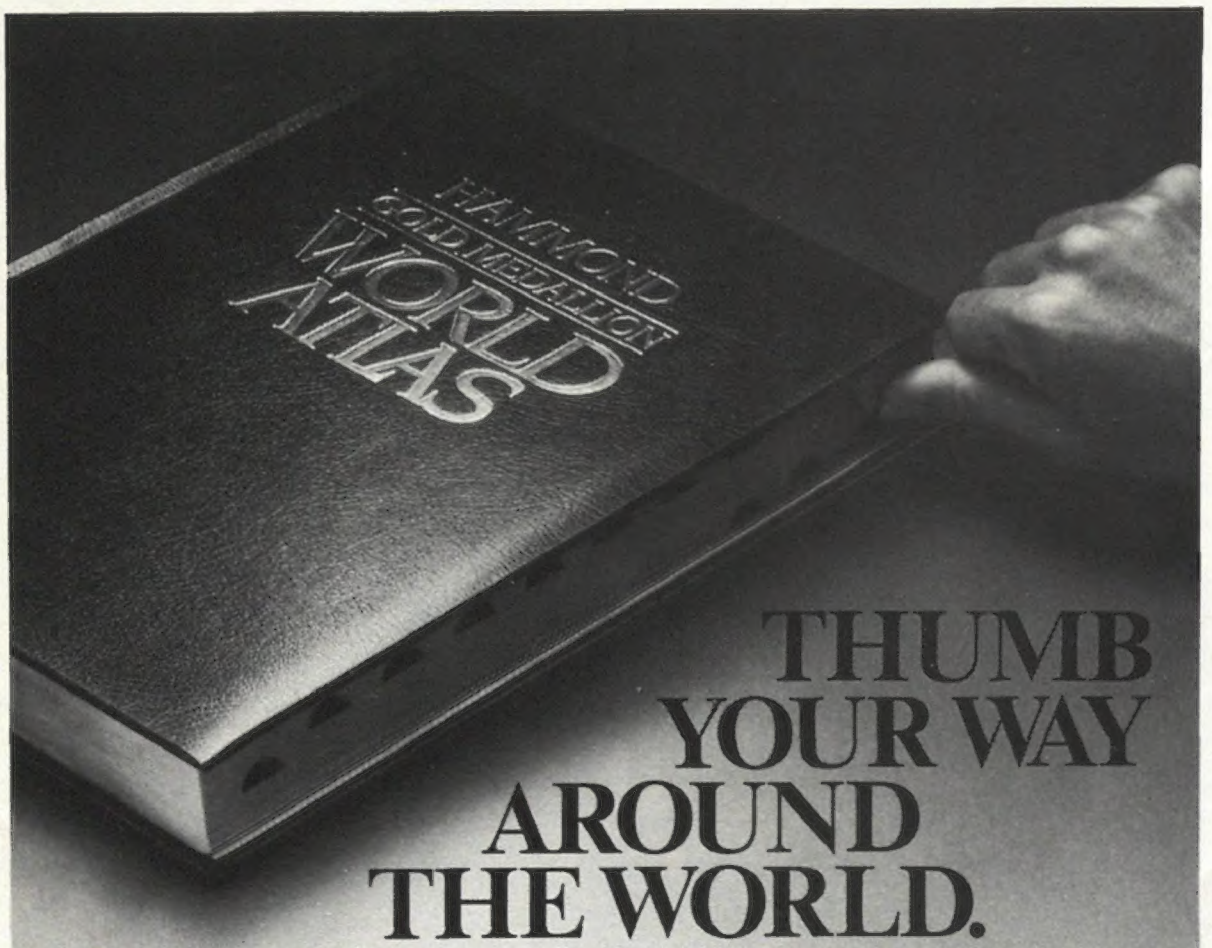

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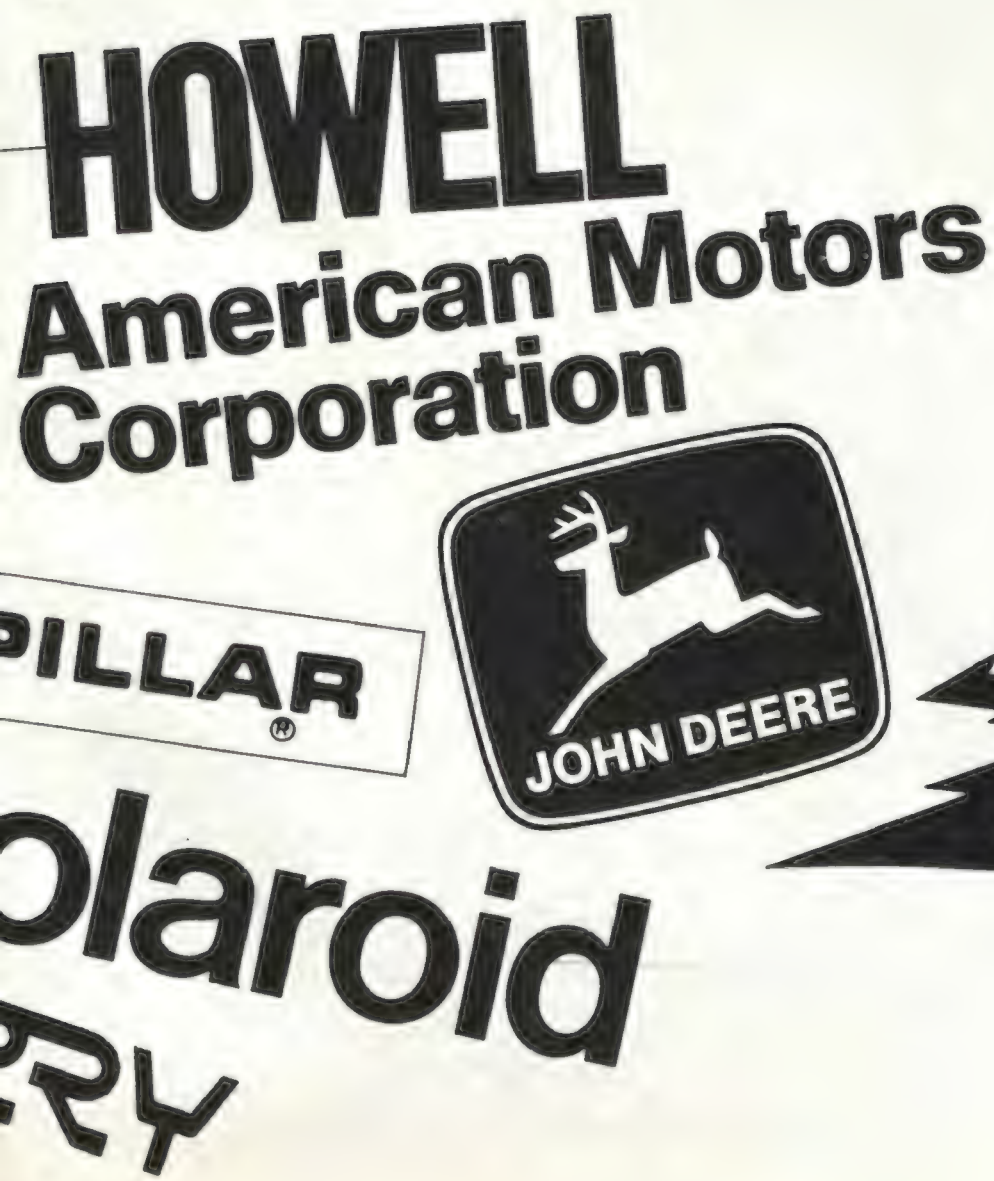

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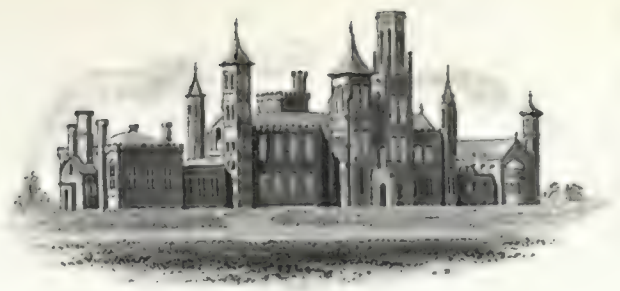


Smithsonian horizons

"The Information Revolution" will probe such complex, unresolved questions as the boundaries of life and consciousness

It is debatable whether there are certain boundaries, or only uncertainties, around life and conscious thought. This does not involve only the current legal and ethical discord over the first of these subjects, preoccupying and confrontational as this has become for us. A clear consensus on definitions or boundaries is also not to be found within the domain of biology, as intensifying scientific interest in primitively reproducing, energy-processing molecules and even prebiotic evolution attests.

The subject of consciousness provokes similar uncertainties. Presumably, it implies a sense of self-awareness, and a capacity for self-directed choices and courses of action that are not fully controlled by instinctual drives or immediate needs. Does a definition along such lines force us to conclude that it is a strictly human attribute? If so, when and how in our own evolutionary record might it first have appeared? Again, a scientific consensus appears remote.

The Smithsonian's National Museum of American History is a new and surprising venue for probing, open-ended discussions along these lines. Plans are under way there for a major new exhibit in 1989 on the Information Revolution, so that the staff is casting a wide net among specialists elsewhere for alternative views on how to deal with its dauntingly abstruse and complex subject matter. Vast and cumulative increases in the storage and rate of movement of information, extending across a century and more, have contributed profoundly to whatever is revolutionary in the processing of information. But it is the much more recent advent of the modern high-speed computer that reintroduces questions that are distinctively and poignantly human about the boundaries of life and consciousness.

It would be relatively simple to portray the computer as a succession of increasingly powerful artifacts, but our aim is more ambitious. Visitors come with widely varying interests and backgrounds. We need to meet them on their own grounds to the fullest extent possible, not with passive displays but with hands-on, interactive, thought-provoking opportunities. Since the visible features of computers are their least important attributes, the artifacts provide no more than superficial snapshots of successive, noteworthy advances. Our real concern instead is to inquire into computers' impacts on our lives, institutions and horizons of understanding. What is their potential for introducing secondary, unexpected changes in our perceptions of ourselves and others, for example, or in the problems we perceive as pressing and seek to answer? Can they stimulate learning, or provide insight into our and our children's cognitive and development processes?

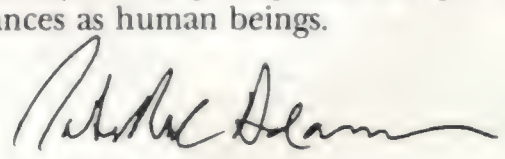
Among the specialists to whom we are turning is Sherry Turkle of MIT. She has been particularly involved with the last of these questions (see *Additional reading*), and is less interested in the computer's present or future capabilities than in our tendency to translate it from a "machine that thinks" into a "machine who thinks." We are all familiar with the airline computer that becomes in some respects an autonomous and "blamable" entity when it misfunctions. Since it is "in some ways on the edge of mind, it raises questions about mind itself."

The ambiguities emerge most strikingly with children, as Turkle compellingly demonstrates. A computer toy, programmed to pursue an optimal strategy with rare mistakes, is accused of "cheating" since it overcomes any consistent opposing strategy. "And if you cheat you're alive." But what is an example of something not alive? "Spiders," a four-year-old replies, "because you can kill them." To others, however, a computer is also not alive because it doesn't have a mother and is not born. "Alive things have babies." Computers "have a maker. But it's not the same as God doing it." "The computer is smart, pretty smart. But it gets its ideas from people." They are like people in their psychology but not in their origins.

Older children move beyond this somewhat unstable and unsatisfying resolution by making finer distinctions: "It thinks like a person but it doesn't feel." Machines are intelligent and have a kind of life, but lack the emotions that make us human.

You may argue that we all move on from these naive characterizations with greater maturity. But it is fascinating to note that biologists, after years of disciplined study, sometimes edge closer to characterizing their animal subjects as sentient beings. Martin Moynihan, of our Tropical Research Institute in Panama, has intensively observed squids, octopuses and cuttlefish. They are "masters of carefully controlled and limited deception," he concludes. Capable of intentional, goal-directed cryptic performances, their behavior "implies considerable ability to select appropriate solutions to difficult problems and to select different solutions to similar problems in different circumstances." Another, very recent example involves James L. Gould's work with honeybees, taking them beyond mere programmed learning of familiar routes and crediting them with the capacity to make a kind of cognitive map of their territories.

Natural history belongs, of course, in our adjoining museum to the east along the Mall, not in the Museum of American History. But the processing of information ramifies into everything we do. And the true subject matter of the Information Revolution is the subtlety and complexity of our perceptions and performances as human beings.



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Letters to the Editor

The allure of jade

Dear Sir: The Arthur M. Sackler Gallery, now nearing completion, will be open to the public in 1987. Those nephrite carvings pictured on pages 34-35 of your August issue are but a fraction of its outstanding collection of Chinese art. They came to us among almost 1,000 objects donated to the nation by Dr. Arthur M. Sackler of New York City.

It was not clear from your otherwise informative article that the new Sackler Gallery will be a separate museum from its neighbor, the Freer Gallery of Art, although both are administered by the Smithsonian Institution's Center for Asian Art.

Thomas Lawton, Director
Arthur M. Sackler Gallery
Freer Gallery of Art
Washington, D.C.

The Titanic

Dear Sir: It is my hope that the wreck will be declared a multinational monument, with the four countries associated with the *Titanic*'s brief life—the United Kingdom, Ireland, Canada and the United States—responsible for it. A floating museum on pontoons could ride above the resting spot to exhibit recovered artifacts and provide space for a library and a nondenominational chapel. Passing ships could visit the memorial and their passengers contribute to its upkeep.

Hunter J. Jones
Clifton, New Jersey

Dear Sir: No mention was made of her being a twin. Her sister ship, *RMS Olympic,* was slightly older but no less impressive in nearly all aspects save luxury.

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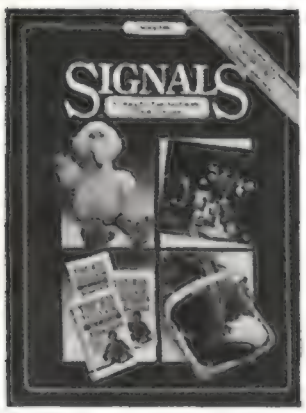

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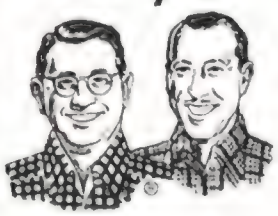

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The *Olympic* was one of the great Atlantic liners of her day, lived through World War I as a troopship, battling and sinking a German U-boat—and finally coming to the end of her days as scrap in 1935.
H. John Conner
Glendale, California

Dear Sir: The Ping-Pong ball technology for raising ships was well developed in the 1970s. It was first published in the early 1950s by Dell Comics, describing a salvage effort by Donald Duck and his nephews, Huey, Dewey and Louie.
George A. Burman
Kailua, Hawaii

The orphan trains

Dear Sir: Your article struck a responsive chord for my 85-year-old sister and me, since our father was one of the children shipped out on such a train. John Crooks and his brother Will were thought to be orphaned when their mother died and their father, a bugler in the Union Army during the Civil War, was reported missing in action. (Later it was learned he survived, but he died before his efforts to find his children bore fruit.)

In Monticello, Indiana, Billy Wright selected my father; his close friend J.C. McQuaig chose the younger brother, Will. Both boys were fortunate in being taken into loving homes where they were raised as sons. Will died childless, but Dad, a pharmacist, raised a family of four sons and one daughter.
Louis G. Crooks
Tallahassee

Dear Sir: I was a child on an "orphan train"! Fortunately, the Children's Aid Society was so advanced in their thinking they took me from a foster home in Brooklyn and placed me for adoption with a single parent in Canandaigua, New York—a retired professor from St. Lawrence University who never married but wanted a child she could name for her mother and send to Vassar.

When the agency's follow-up visitor came to check on me, I hid in the lilac bush for fear she would take me away!

I never thought much about my parents until I sent for my birth certificate in applying for Social Security. Learning that my father was Norwegian, my mother Swedish, has made me look forward to a trip to Scandinavia.
Margaret Freeman Tompkins
Richfield, Pennsylvania

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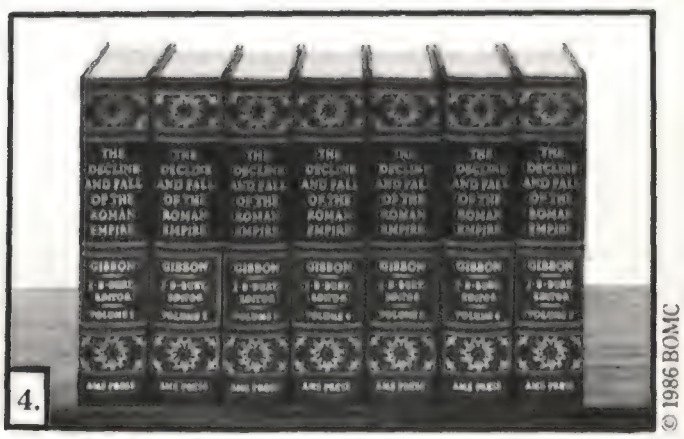
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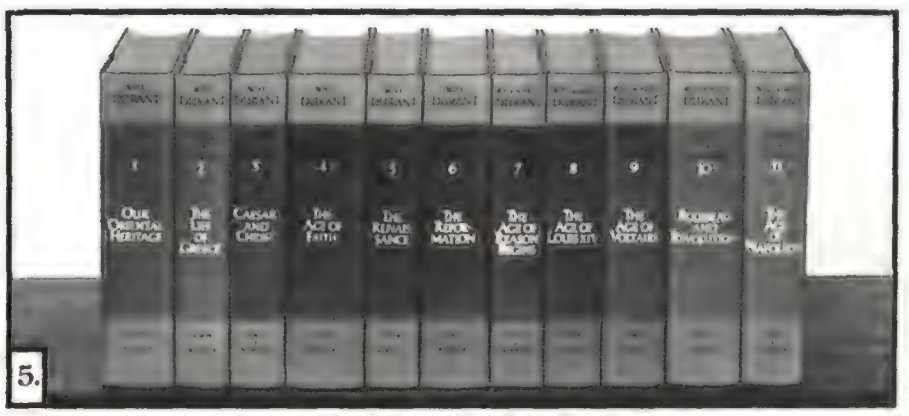
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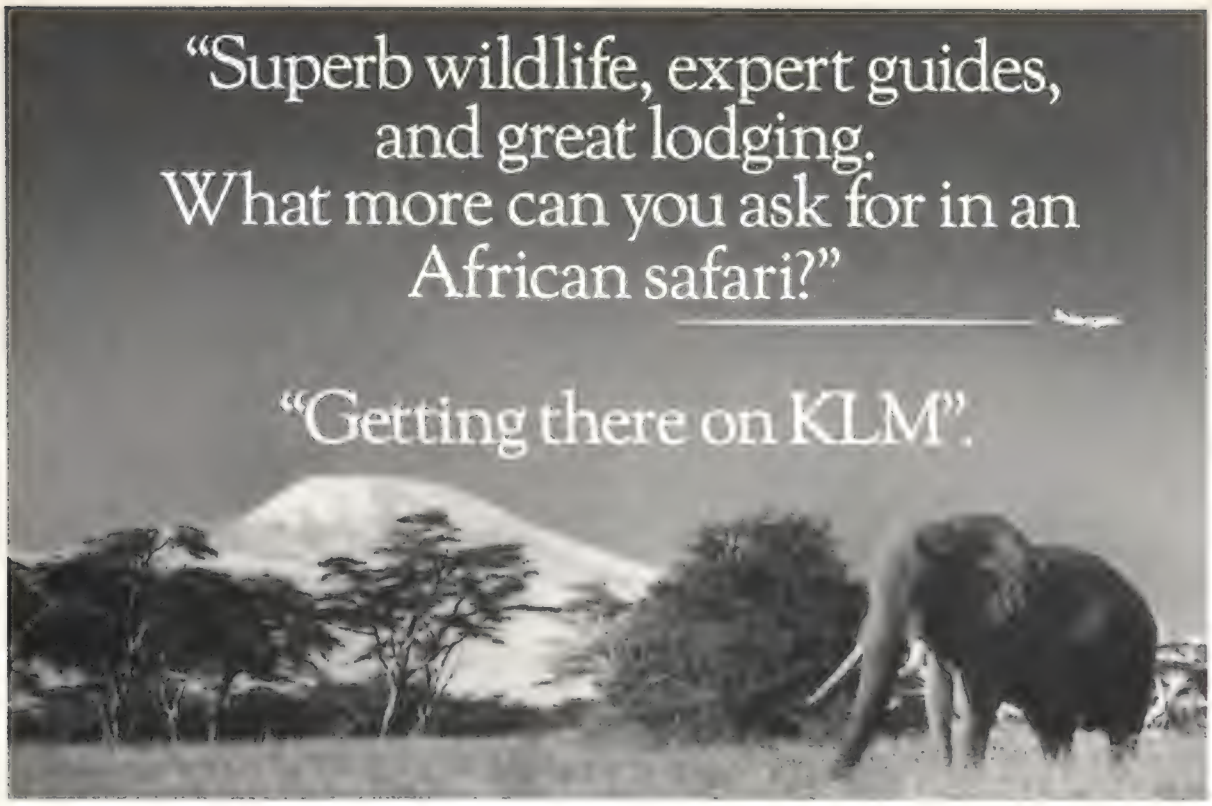

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Dear Sir: My stepfather, an orphan from the New York Foundling Home, was sent by train to Minnesota with other children when he was three or four. He remembered the train trip, the small-town depot and people picking out children.

His life with his foster parents was not happy. After the birth of their own girl, it was even worse. His foster father was brutal, soaking a rope for several days before beating him. My stepfather bore the marks on his back the rest of his life. He found his adoption papers, with a name and birthdate, ran away and assumed that name. Befriended by another family, he then worked for them for his keep.

Bitter over his experience, he contacted the Foundling Home in an attempt to find his true identity, but received no answers.

I wonder how many children were as fortunate as some of those mentioned in the article.

Jacqueline Sahlman
Bay City, Oregon

Dear Sir: My father was one of the orphan-train children. Born in Brooklyn in 1868, he was an orphan by 1874. He lived with various farm families in Missouri. He said that many times, as they sat down to dinner, they found there was nothing more on the table to eat than boiled potatoes.

My father was told that he was going out to join his older brother. It appears that at times the two were separated by only a few miles, but it turned out that they never got together again until 1904, when each put an ad in the same issue of the *Modern Woodmen of America*, asking for information about the whereabouts of the other. Many of these children did make significant contributions to the future of America, which is remarkable, considering that they started at just about zero.

Dr. Evan W. McChesney
Delmar, New York

Dear Sir: For your readers who would like to learn more about the orphan trains: my colleagues, Evelyn Sheets and Evelyn Trickel, and I are preparing a book for publication in the fall of 1987. We are also participating in the making of a television documentary on the subject.

Michael D. Patrick
University of Missouri, Rolla

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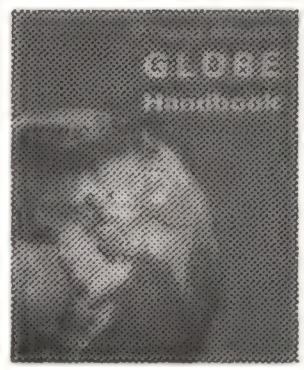

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Mowat family sand sculptors of all ages created floppy-eared Ralph, top dog on beach at Fort Worden State Park, Washington.

Sandcastles

Dear Sir: Last July, the members of our family-reunion group created a sand sculpture, a "Pound Puppy," complete with bowl, doghouse and bone [above]. It won first prize in the "families" category at the annual Sandcastle Contest in Port Townsend, Washington.
Gala Mowat
Piedmont, California

Controlled forest fires

Dear Sir: I was struck by Mr. Smith's lack of information regarding wildlife inhabiting the timberlands in question. How do living creatures other than hikers fare in the prescribed blazes?
Howard Cutler
Hauppauge, New York
Large mammals, as a rule, escape well ahead of fires. Some small animals may be caught in a blaze, but the survivors quickly return to repopulate burned-out areas. Ed.

The tickle-tongue tree

Dear Sir: Tickle-tongue tree? In 1941, a refugee from the Japanese invasion of China, I returned to my old home in Minnesota. As a child I had roved those fields and pastures with a chum. We had created for ourselves a little den, burrowing with the help of pruning shears and hatchets into our secret hiding place at the heart of a prickly-ash thicket.

Back from China subdued and middle-aged, I wandered that same terrain, discovering a landscape that was changed beyond belief. But suddenly a familiar scent brought a rush of memories flooding back. There, before my eyes and still recognizable, was our clump of thorny bushes bearing, as it had so long ago, hard, shiny berries in their brownish papery hulls.

But that was not all. Where else had I met that distinctive yet undefinable aroma? A necessity in Chinese cooking is a spice we called *hua jiao.* Nowadays it is relatively available in Oriental food stores under the name of Szechuan pepper, but then, in Minnesota, it was unheard-of. I gathered a handful of prickly-ash berries and sniffed them. Smaller, harder, shinier but indubitably *hua jiao*! I set out for home and triumphantly created a stir-fry that tasted the way stir-fry ought to taste.
Emily Exner Chi
Chapel Hill, North Carolina

Phenomena

Dear Sir: I read Mr. Wiley's column with understanding and joy. I, too, put quotation marks around my own age, "66."

Of the many down-to-earth sayings attributed to the late Satchel Paige, the one I most enjoy is: "How old would you be if you didn't know how old you was?"
E.J. McMullen
Elkhart, Texas

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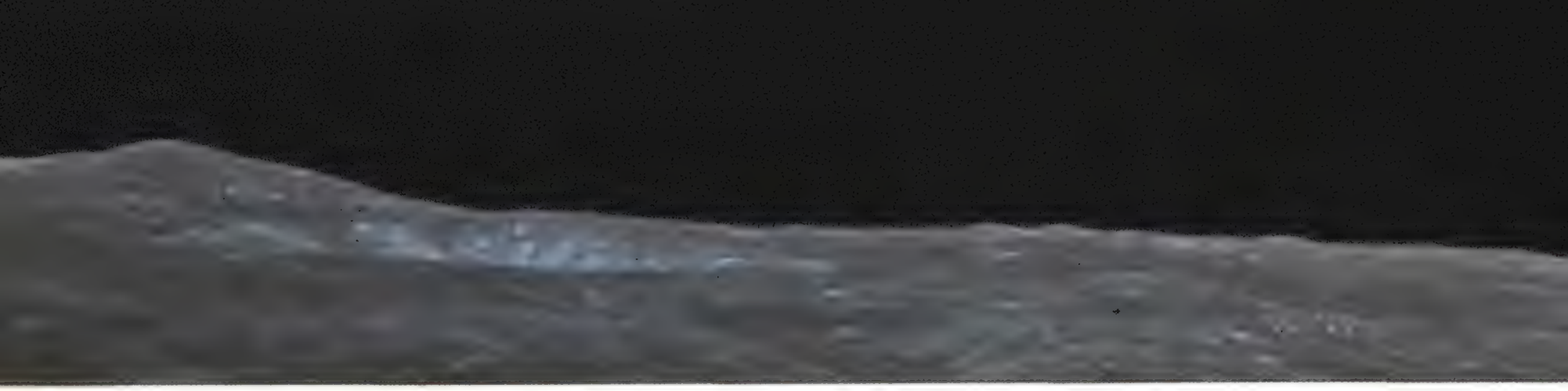

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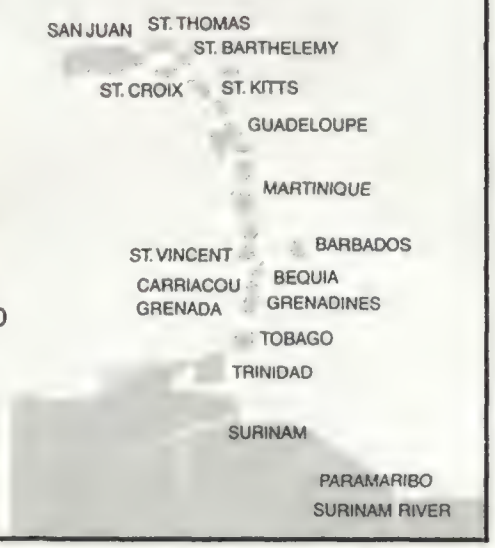

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Around the Mall and beyond

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Oddly enough, there are those of us who have trouble fully understanding the above example of normal cocktail-party conversation in our nation's capital. But beginning next month a Smithsonian Resident Associates course called "American English in Washington, D.C." will help get everybody with it.

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This broad interest suggests that most Americans outside Washington haven't the foggiest notion of what those inside Washington are talking about, and that even the insiders aren't very sure of what they're saying most of the time. That

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☐ I would like to be advised of other owls in the Boehm Collection.

26-3

would surely help explain the mess we always seem to be in.

The course, however, was not designed for bemused American citizens as much as for our friends from all those embassies along Massachusetts Avenue and similar nice Washington addresses. Embassy staffs are carefully selected and their personnel are often fluent in English. But fluency doesn't help when, in the course of ordinary domestic life, a highly educated and qualified woman from, say, Madagascar, confronts "Whopper shopper," or when a capable and scholarly aide from Korea, cruising for a quick lunch, faces signs reading "Dunkin' Donuts" and "Jerry's Sub Shop."

"We've often done programs based on foreign cultures," says Paul Edelson, Director of Adult Courses for the Resident Associates. "And not long ago we put on a course in advanced French for those who already spoke French well. And it occurred to us that we could give Washington's foreigners the same advanced course in English to supplement what they already know."

Paul's idea was approved, and he got hold of a colleague, Kathleen Diamond, head of Language Learning Enterprises in Washington. She will instruct absolutely anybody in more than 50 languages, and she had no problem clicking with Paul Edelson on the idea of this course and working out the details. The sessions were planned—two on media English, everything from film talk to jingles; then evenings of commercial English, government English and finally cocktail English. Pam Monder, charming, bright and a marvelously American young woman, put her neck on the line as teacher.

I went to a couple of the sessions and found that the majority of the students were women. A list of the nationalities involved included French, Sri Lankan, Thai, Cambodian, Japanese, Uruguayan, Korean, Brazilian, Peruvian and Chinese. I may have left out a couple. They were all, as I expected, bright, well-educated staff people from their respective foreign services.

Pam asked them to produce a word or phrase they had run into since last week which they didn't know.

"What is this 'Whopper shopper'?" one of them asked.

"A 'Whopper' means something big . . . enormous."

"But I am not so very big."

That was worked out. So was "crow's feet," those crinkly lines around the eyes, which the students thought a rather charming piece of Americana. "Dunkin' Donuts" made sense after Pam reminded her class of "dunk," a word most of them knew and liked. "The misspelling draws attention," Pam said. And with that secret of American commerce firmly in mind, they were able to handle "Sta-Brite" cleaners, "Hair-em" ("harem," get it?) beauty salons and "Price Rite."

"Audiokrafters" suggested the special flair that a foreign-looking word has in advertising. The class understood instantly. But "billboard" stopped them. "A board where you put a bill?" asked the man from Sri Lanka. I realized that, living in Washington, they simply don't see very many billboards.

Pam worked over a list of trade names that have become so familar, so positively generic, that they are applied to whole categories of products. Any tissue is apt to be called Kleenex and any bandage a Band-Aid. Any cotton swab is

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a Q-Tip, and, to the distress of Pepsi-Cola, any brown fizzy soft drink is a Coke. We may speak of wearing B.V.D.s, Dr. Dentons, Keds and Levi's when really we're wearing quite different brands.

"Any more words or phrases that puzzle you?" Pam asked.

Yes. What about prankster, frumpy, stint, cut one's teeth on, political buzzsaw? I was surprised that so many everyday idioms confused them, while they often recognized the more outrageous slang. Discussing music, Pam groped for a word to describe a certain sound.

"Mellow," suggested a student.

"Perfect," said Pam.

"I know," said the student. "I've been to California. I know 'mellow.'"

Media terms included network, prime time, anchorman ("I'll call it 'anchorperson,'" Pam said, firmly) and a little briefing on film ratings which the students seemed not to need. One woman discreetly defined an X-rated film as an "art film."

But Pam's run-through of giant sandwiches had them—and all the American reporters and camerapeople—astonished. What we in Washington call a sub is a hero in New York, a grinder in Chicago and a hoagie in Florida.

Governmental words often baffle us all. These embassy people, however, are Washington-based and often seemed to have been briefed about the old reliables: "lame duck," "filibuster" and "landslide" or "avalanche." We ran through "knee-jerk liberal" and "rock-ribbed Republican," and Pam asked for ideas of how to describe a moderate. She got "flip-flop" from the floor.

"Yellow dog" fooled everyone, except a few politically oriented newsmen who were listening in. Yellow dogs are Democrats, generally Southern, who'll back anyone the party puts up, even a yellow dog. "Boll Weevils" are conservative Southern Democrats. And "Gypsy Moths" are liberal Republicans, generally New Englanders—or so the teacher says.

The class knew where the "Hill" is. They knew "red tape." They knew baseball terms and instantly caught on to "hardball." They didn't have a clue about football. They liked the words "junket" and "gobbledygook." They were uncertain about "railroading" and "barnstorming."

Pam explained "gerrymandering" (soft "g"), linking it to old Elbridge Gerry of Massachusetts, whose name is pronounced, curiously, with a hard "G." I wanted her to explain "mugwump"—in my lexicon, the indecisive politician who sits on a fence with his mug on one side and his wump on the other—but she knew better.

The class was further briefed by a couple of government officials who described the difference between a Bill and an Act and pointed out that to most Americans, government means state government. Washingtonians have the privilege (although perhaps not all of them would agree) of living next door to the federal government. Phrases like "ground swell" and "grass roots" cropped up, along with "mudslinging," "political suicide" and "rigged elections."

The last session, on cocktail-party conversation, was largely carried on by a couple of "plants" in the classroom—outsiders who involved the students in the sort of vacuous chitchat that they can expect in the Washington salons. Spontaneity took over and the class got into the act. But there were also a number of quite serious considerations.

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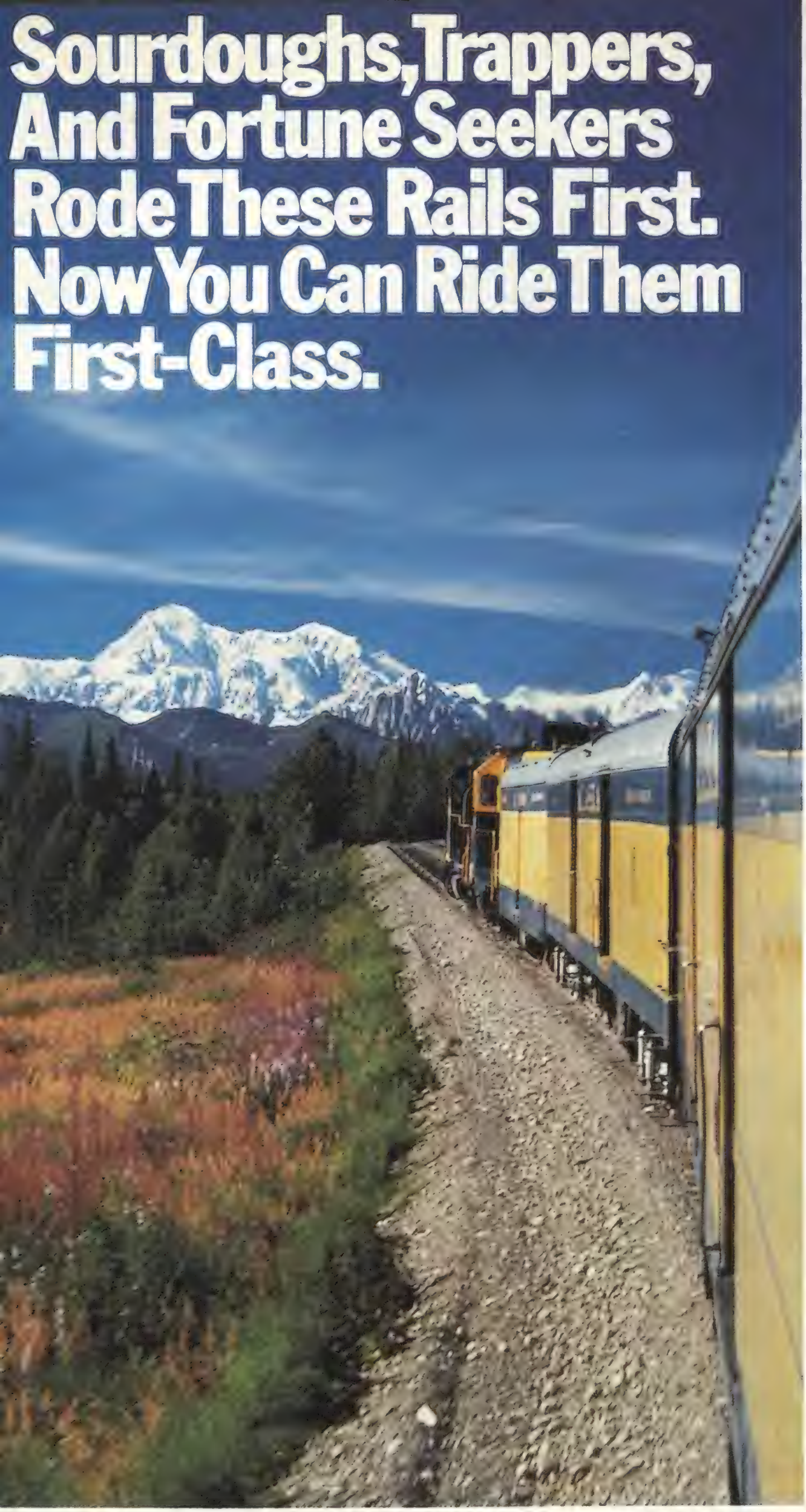

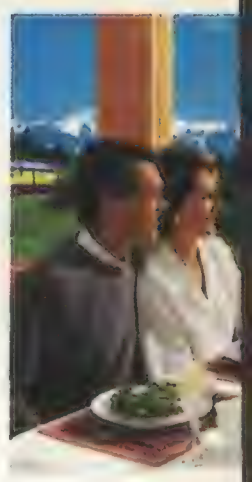

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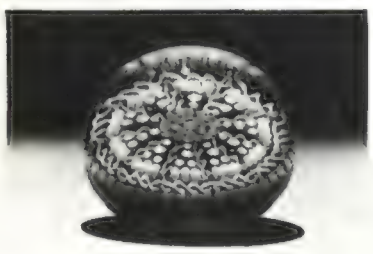

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Two: How do you break the ice? I doubt if any class of embassy people will have much trouble with that one. When I sat in, last summer, I found them all delightful and *I* was the one who generally broke the ice.

Three: What are safe topics in Washington? I don't exactly remember the answers to this one, but I do recall a review of the government rating system—the difference between a GS-15 and a "supergrade," for example—which our foreign friends should know in order to communicate without embarrassment.

Communication is what it's all about. We Americans quite unconsciously say things that may easily baffle a Uruguayan interpreter—and one just happened to attend last summer's sessions. She was a nice lady who said she had joined up to keep abreast of her job and that she was learning a lot.

Auditing part of the course, I realized that our normal speech is so deeply idiomatic that we can't really control it. One of the visiting government experts, for example, finishing his explanations, said, "Now let me wrap this up for you . . ." and I noticed two students look at each other blankly.

So that's the rundown on this Smithsonian rap session that takes off November 6. You've still got time to knock a few heads in your embassies and get a go-ahead to jump on the bandwagon. It can't hurt. After all, not all Americans express themselves as clearly as I.
Edwards Park

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Phenomena, comment and notes

Trails make Rocky Mountain National Park totally accessible, but you have to be in shape to rise to the challenge

Marathon runners "hit the wall" somewhere around 18 miles into a race. They momentarily run out of steam, feel they cannot go on. Yet go on they do, find that second wind and even finish with a kick. You don't hear much about walkers hitting the wall, but it happens. In Rocky Mountain National Park, I found myself hitting the wall about every 50 feet—and that was on the "easy" trails.

For an Eastern flatlander, the park is a wonderland, a wildly three-dimensional world. Driving through it is like swimming over a large reef: you look down into valleys and chasms and across jagged upheavals and outcrops to the next high point. Parked, you watch a bird take off and fly horizontally away from you; when it is a hundred feet away, it is a thousand feet above the ground. You feel a pull on your eyes as strong as that which some people feel when they look down from a high bridge, except this force is pulling you out like that bird to enter three-dimensional space.

Best of all is simply walking. Being on foot is the ultimate freedom, a complete immersion in the landscape. Body becomes one with the topography as feet crunch in the rock dust of the trail, lungs gasp for more oxygen in the thin, clear, sun-filled air. Hands feel midday warmth in the trailside boulders, some left by retreating glaciers, others that split off the mountain up whose flank you are laboriously working.

Walking makes you appreciate every foot of trail and especially every foot of altitude you gain. For a middle-aged

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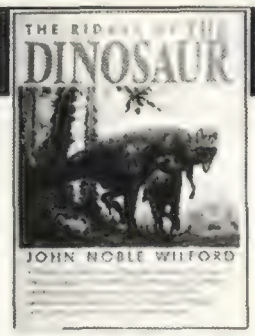

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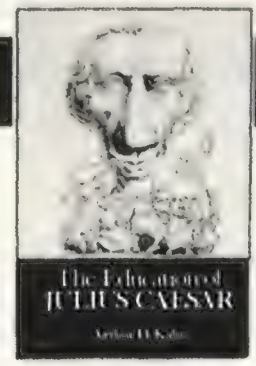

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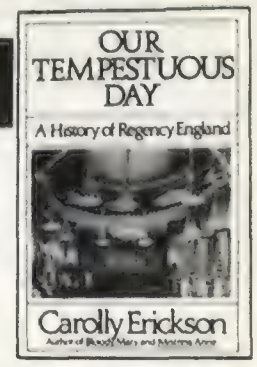

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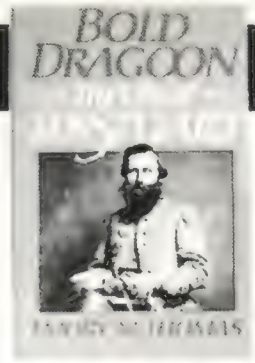

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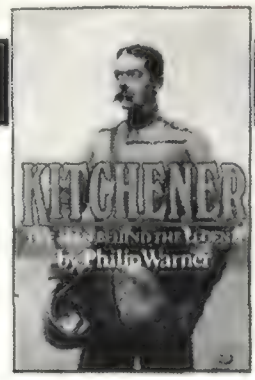

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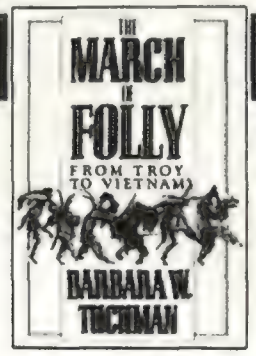

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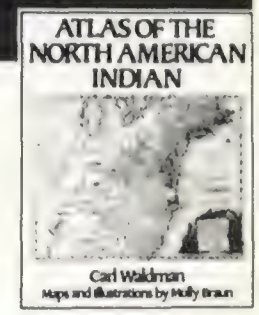

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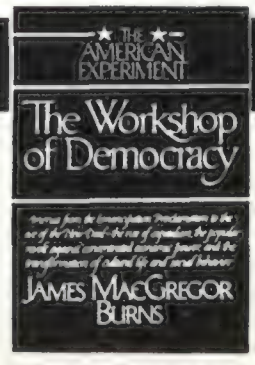

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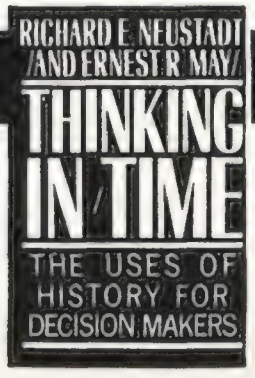

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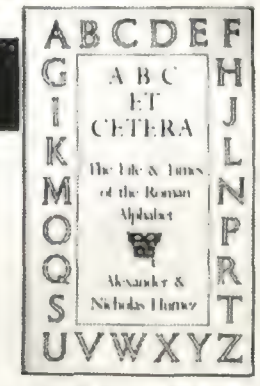

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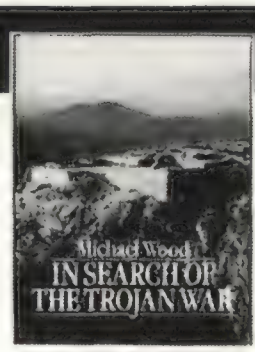

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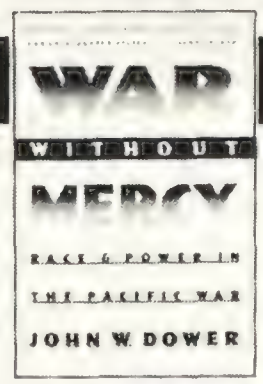

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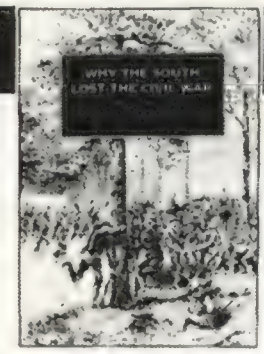

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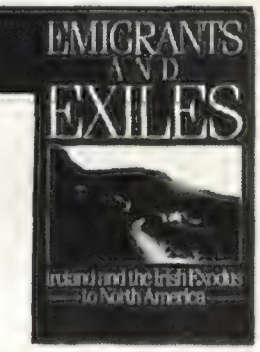

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man in poor condition, unaccustomed to high altitude and fighting a cold to boot, a mile can take two hours. Walk a little, then hang on to a tree; walk and hang on. Yet every stop is a gift, time to notice the yellow-bellied marmot sunning itself a few steps away from the trail, or the cage at the edge of a cliff 1,000 feet above you, used by biologists to hack peregrine falcons.

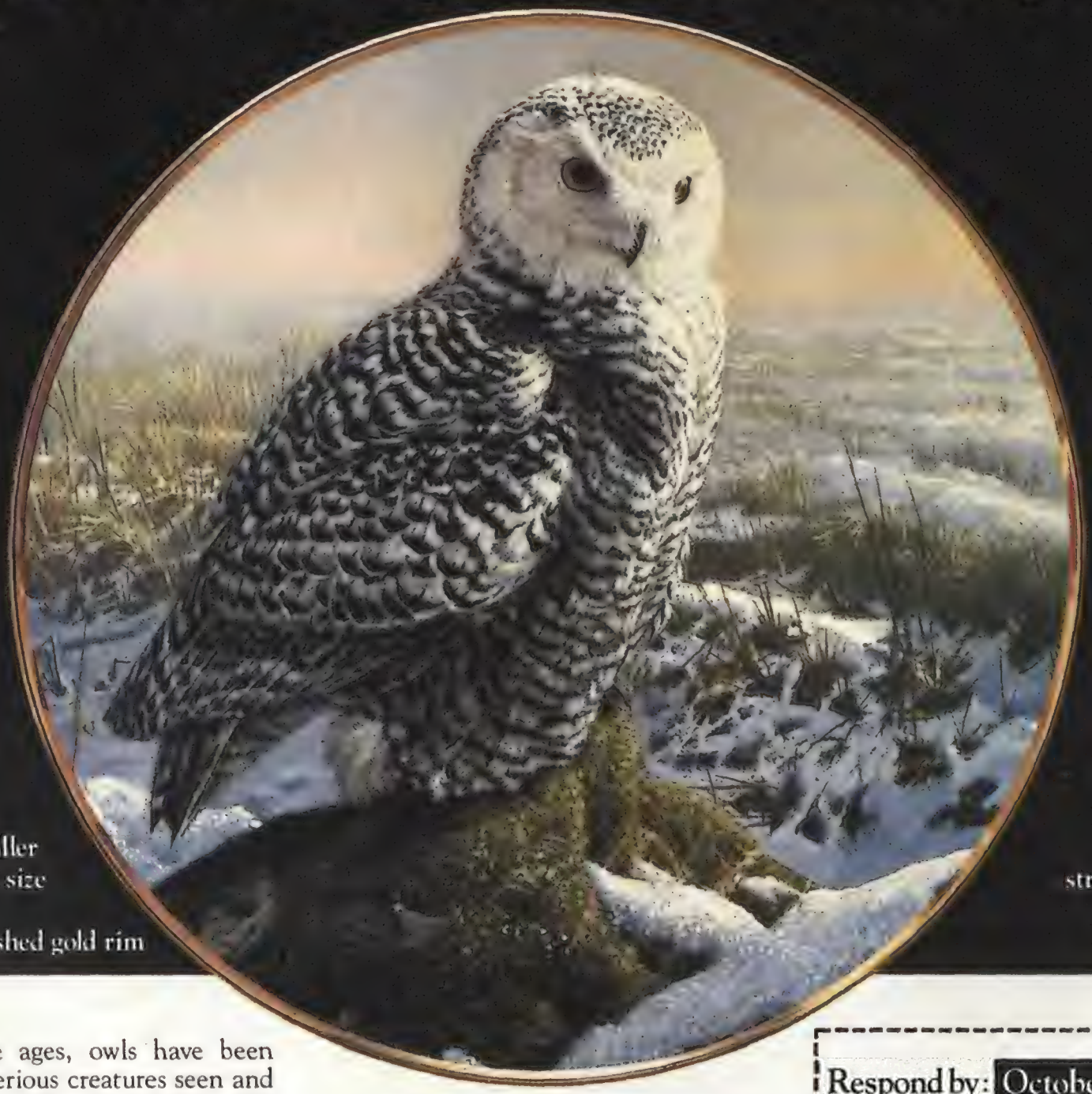
Being in the park was a gift in itself. At the foot of Eagle Cliff Mountain, on a gentle slope of glacial till, is a cabin used every summer from 1912 to 1943 by William Allen White, the Kansas journalist. The Park Service has restored the cabin and for the past three years has invited artists—photographers, sculptors, painters, composers and writers—to use it for a week to several months at a time. This year I found myself in that cabin, sitting out on the porch in a hickory rocker once used by people like William Jennings Bryan, Jane Addams and Charles Evans Hughes.

History here goes back as far as you want to go. We have pictures of the first settlers, who tried ranching but found more profit in providing accommodations to travelers who had come to see the mountains. We have the tools and the stone walls—used to guide game to the kill—of predecessors of the Ute and Arapaho, who crossed the Continental Divide here.

Moving into geological history, we have scoured rocks, moraines and lakes—many of them left during the last major glaciation when it ended 12,000 years ago. Finally we have the mountains themselves, a history of the Earth stretching back 1.8 billion years. It is a tale of great seas laying down sediments perhaps miles deep, of folding and melting, of ancient mountain chains that probably ran east to west. A second mountain chain, the Ancestral Rockies, rose from a later sea about 330 million years ago. Erosion wore these down until only a low-lying plain was left and then the seas returned. About 70 million years ago the land began to rise again, pushing up in stages, until the Continental Divide reached 13,000 feet. The mountaintops stood above the elevation of permanent snow, creating the conditions for the glaciers that would carve them into the bold relief we see today. To geologists, these newest mountains are Rocky III.

From the porch of the White cabin, the mountains invite. The park has 355

Capture the Majesty of the Snowy Owl



- Shown smaller than actual size of 9½"
- 22K burnished gold rim

- Edition strictly limited to 15,000 worldwide

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Through the ages, owls have been viewed as mysterious creatures seen and heard mostly at night. And perhaps the most beautiful of these unusual birds is the Snowy Owl, representing a form of natural beauty that strikes a balance between gracefulness and strength.

Now, famed wildlife art master John Seerey-Lester has captured the striking Snowy Owl and its rugged environment in "Morning Mist," his very first limited-edition collector plate. Only the extensive research and exceptional talent of this wildlife artist could capture the female Snowy Owl to such perfection, as it surveys the vast plains of its territory. The respected Spode Studios present this masterwork on their large, 9½" plate of flawless English bone china, with a rim of 22K burnished gold.

"Morning Mist" represents an important premiere in limited editions, because of the appeal of the theme and renown of the artist. In fact, as experienced collectors know, a wildlife-theme plate of this calibre may see superb secondary market success, as collectors compete to own the limited number of plates in the edition.

"Morning Mist" is the first issue in a breathtaking collection of eight entitled the *Noble Owls of America* Plate Collection, available exclusively from The Hamilton Collection. As an owner of "Morning Mist," you may acquire all future plates as they are available at the same issue price. But you may cancel your subscription at any time and be released of all further obligation. Furthermore, you may return any plate within 30 days of receipt for a full refund under our *100% buy-back guarantee.*

Morning Mist

by John Seerey-Lester

Each issue in this magnificent collection by John Seerey-Lester will pay tribute to an American owl in its natural habitat. Each will be available at just $55.00 and will be limited to 15,000 worldwide. The signature of the artist and hallmark of Spode Studios will appear on the reverse of each plate.

The renown of artist John Seerey-Lester and Spode Studios as well as the popular theme point to swift and strong demand for this important premiere plate. Because the edition is strictly limited, it is important that you respond promptly. So to avoid any chance of disappointment, order today!

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miles of trails and you can go just as far and as high as you want—and can. You can walk across the park, crossing the Continental Divide just as the Utes once did, or you can stroll around the nature trail at Bear Lake.

The ambitious immediately head for Longs Peak, at 14,255 feet the park's highest. Technical climbers like to scale the 1,000-foot vertical wall of the east face; others take an easier route and walk the eight miles and 4,700 vertical feet from trailhead to summit. Almost anyone can do it, they say. Five-year-olds have made it and so have 85-year-olds. One park ranger, a triathlon competitor, made it from trailhead to summit to trailhead in two hours and nine minutes. The peak is visible from downtown Denver; from the cabin it is almost hypnotic, pink in first morning sun, swathed in shadow at sundown. Luckily for the rescue teams, I resisted the call.

The trick, it seemed to me, would be to start high. So a friend and I drove up the Old Fall River Road, a one-lane, one-way dirt road that gives tourists a taste of driving there in the 1920s. We parked at 11,000 feet and started up the Chapin Pass Trail. A few hundred feet along, a smaller trail branched off to the right, going to Mount Chapin and beyond to Mounts Chiquita and Ypsilon. Off we went, up and down across treed ridges and grassy valleys, stopping sometimes to look 1,000 feet down into the willowed valley along Chapin Creek. The trail cuts around a hillside alive with yellow alpine sunflowers, white dryads, blue sky pilots; you begin to wonder if you are in a movie about Switzerland. Farther on you scramble up a crumbling trail, where rocks are falling out and rolling down the hill. Lunch near the tree line, where two vernal pools are half evaporated and the mosquitoes are ferocious.

From here the route parallels the mountainside, angling off to the saddle between Chapin and Chiquita. To the right is the long gentle slope, carpeted in the flowers of the Arctic tundra, that leads to the crest of Chapin, no more than half a mile away and 800 feet up. We already know that the view from the top is dramatic: the other side of the mountain is a jagged, precipitous wildness, looking as though that half of the mountain had been ripped away by some huge hand. And yet we know we cannot make it to the top. We are too tired and soon the afternoon thunder-

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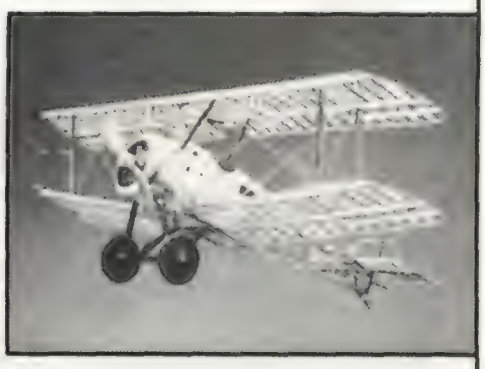

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storms will develop. It looks so easy, but it is out of reach.

Going up we had met a man my age coming down who said he had decided against going to the top of Chapin. I understood perfectly. But then he added that he didn't want to tire himself because he was climbing Longs the next day. Not my type at all. His wife and his father had continued on and we met them as they came down. The father explained he kept in condition by running six miles every day in the heat of Dallas.

Jogging has never interested me; the people who daily pound up and down Washington's Mall have always looked to me like they were doing penance for some egregious sin. Yet if a little running now and then means you can make it to the mountaintop, then just maybe there is something to it.

The essence of the park is the one-third of its area, about 83,000 acres, that lies above tree line. We had asked Glen Kaye, the chief park naturalist, for a good place to walk. He suggested starting from Bear Lake, crossing Flattop Mountain and coming down Andrews Glacier, "an easy 12 miles." That's the challenge of the park: it is all there for you to do—if you can. We decided we weren't quite ready.

By most definitions, Rocky Mountain National Park is crowded. About three million people come every year, mostly in the summer. Perhaps 600,000 people walk the backcountry trails, especially the easy ones. Fifty years ago families would spend two or three weeks in one of the lodges that dotted the park. Now most come for the day. Some just drive through on their way somewhere else.

Park managers worry about all those feet. Buck-and-rail fences line the roads in a few places, so the vegetation behind them has a chance to regenerate. Visitors are urged to stay on the trails and not take shortcuts on switchbacks; in the tundra they are asked to hop from rock to rock as much as possible. Despite all the worry, however, the park does not look like it is being loved to death. Some trails are eroded, to be sure, but the damage looks confined. People do stay on the trails and, remarkable to Eastern eyes, they do not throw trash around. I was there for 12 days before I saw my first—and last—beer can. Perhaps it is difficult to look at that landscape and then trash it.

Late one afternoon we had stopped to watch a buck mule deer make his way through a meadow next to the trail. A woman ahead of us took it upon herself to walk back and announce: "There's no wildlife here and there's none in Great Smoky Park; we were there too. If you want to see wildlife, you've got to go to Yellowstone." Disappointing news. But perhaps she was right. After all, we never saw more than 20 or 30 elk at a time grazing in alpine meadows or walking across snowfields. We never saw more than four bighorn sheep at a time, and never closer than 100 feet. We never did see the black bears or the porcupines, not to mention the mountain lions. (The latter are there, though; last year rangers found one who had been pinned at the pelvis when the elk he was killing fell on him. The mountain lion died with the elk on top of him.) We had walked by any number of beaver ponds, and one spot where the ambitious rodents were dropping 12-inch-diameter aspens in an attempt to dam the Big Thompson River, but never saw a beaver.

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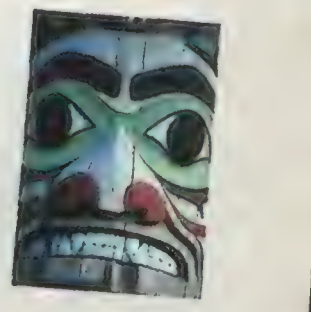

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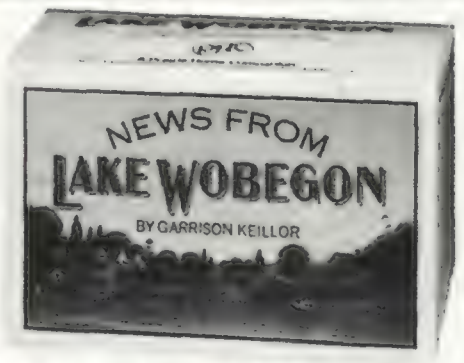

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From the William Allen White Cabin, snowy peaks lure the physically fit.

Back at the cabin, wildlife was equally scarce. If you ignored the broad-tailed hummingbirds that would fly up to your face and hover there while they looked you over, the golden-mantled ground squirrels busy filching peach slices out of your cereal bowl, the bats patrolling the front yard at dusk while deer ambled through the willows to the stream, the yips and yowls of coyotes at night, well, there wasn't much. Being new, I was able to add six birds to my life list while sitting on the porch, but once you've seen a yellow-bodied, black-winged, redheaded western tanager or the flashing blue flame of a mountain bluebird hovering over a field, then what do you do?

The park is no paradise, of course. Fully 25 percent of the budget goes for park ranger work, some of it just plain tragic. There was the mother who sat her infant on a rock in the middle of a rushing stream, turned back for her camera and looked up to see the baby gone. Or the father who wanted to show his family how much fun it would be to slide down a snowfield. He couldn't stop, slammed into the rocks at the lower end and died of multiple injuries.

Despite the crowds of people, park managers are working to return the park to pre-European conditions. All the old lodges are gone and private cabins and other structures are taken down as they are acquired. A cable bolted to the side of Longs Peak for the benefit of climbers was removed in 1973. Three leaky old dams in the Wild Basin section are on a list for acquisition and demolition. Plans are being worked out for prescribed fires that would burn off the litter, brush and old forests accumulated during decades of fire suppression (SMITHSONIAN, August 1986); then natural wildfires can be allowed to resume their role in the ecology of these mountains, eventually producing the vegetational mosaics that once graced these slopes. Just as they have reintroduced river otters and greenback cutthroat trout, biologists would like someday to reintroduce wolves, the only natural way to keep elk herds at healthy levels.

Suddenly it is evening on the last day. Thunderstorms march across the park. Longs Peak is bathed in clouds, lightning strokes and, we see when it clears, snow squalls. The sulfur flowers and serviceberry bushes around the cabin, which receive only 16 inches of precipitation a year, have had a good soak and the air smells alive. Bluebirds are out again and green-tailed towhees are flitting in the bitterbrush. Big Thompson is surging through the meadow. As always, our eyes are drawn upward. In sunshine and shadow, the peaks run from horizon to horizon: Meeker, Longs, Storm, McHenrys, Thatchtop, Taylor (with its glacier), Hallett, Flattop, Notchtop and Gabletop, finally punctuated in the west by Spruce Canyon, from whence a glacier once came.

Glen Kaye asked one day if we could "feel" the mountains and I think I am just beginning to. For the first time in my life I want to climb a mountain, not to "conquer" it but to know it. For the first time they seem accessible; all I need are legs that will carry me there. I feel their pull now, a physical attraction that transcends visual memories. Home again, on the edge of the coastal plain, I exult in walking up stairs, up hills. Each step is the beginning of some future ascent of Chapin, of Flattop, of Longs itself. And some dark night in the near future, when I am out walking the dog while the neighborhood sleeps, I may just look up and down the street to make sure no one is watching and then awkwardly, self-consciously, break into a run—not to be trendy but to start on a path to the alpine flowers, snowfields and mountaintops of Rocky III.

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"Que será, será." *Anonymous Accord LXi owner.* HONDA

By Emily and Per Ola d'Aulaire

'Their mission: make damn sure nothing comes unraveled in the air'

It requires 'twidgets' and 'knuckledraggers,' 14,703 man hours and $2.5 million to perform a major safety checkup on a modern jetliner

It is 10 A.M., May 13, 1986, and a stiff breeze whistles across the low mountains that separate San Francisco International Airport from the Pacific Ocean, a half-dozen miles to the west, as United Flight 806 makes its final approach. Thrust reversers roaring, the great aircraft slows to a near-halt on the northwest runway. Beyond looms an enormous hangar, a colossal, crate-like structure that could harbor four football fields side by side, with eight-story-high double doors that ride rails of steel, opening and closing with a rumble of wheels and the clang of warning bells.

The cavernous building—one of half-a-dozen boxy structures at the site—swarms with activity. Inside, surrounded by an elaborate array of movable stands and automated docks that close around aircraft like giant spiderwebs, three jumbo jets repose with the majesty of queen bees, their needs attended to by hundreds of mechanics who come and go 24 hours a day. Some garbed in grease-stained overalls, others in cords and button-down shirts, they check, probe and measure; inspect, reject and replace; repair and despair over the heartbeats and health of every jumbo, narrow-body "guppy" (nickname for 737s) and other plane that comes within range of their air wrenches, voltage testers and ohm meters. Their sacred mission: make damn sure that nothing comes unraveled in the air.

Seven days a week, 52 weeks a year, work goes on at United Airlines' Maintenance Operations Center (MOC) in San Francisco. The chief service station for the country's biggest air carrier, United's MOC is the largest private aircraft-maintenance facility in the world, a vast complex so spread out that bicycles and battery-driven carts shuttle between buildings carrying technicians, spare parts, tools and test equipment. Nearly 8,000 mechanics, electricians, sheet-metal workers and engineers work round the clock to keep 357 planes running smoothly each year.

Flight 806, a Boeing 747 just in from Hong Kong, disgorges its 196 jet-lagged passengers at the main terminal, then taxis across the runway to park in front of the enormous hangar. A layer of hoarfrost still clings to the underside of the craft's wings, testimony to the chill of the atmosphere eight miles up. One of more than a dozen jumbo jets recently purchased from Pan Am when United acquired its Pacific route system in early 1986, this 747 has just completed its 4,345th flight since it left the Boeing factory near Seattle in 1979. It has logged a total of 33,755 hours, 46 minutes in the air. It's time for a major tune-up.

Barely have the four engines whined to a halt before a crew clambers aboard and starts dismantling the seats still strewn with earphones, playing cards and copies of the *South China Morning Post*. "Everything's got to go!" yells Steve Blackwood, a maintenance foreman, as workmen wielding pneumatic socket wrenches and screwdrivers play demolition derby with the cabin interior. "We're going to strip this bird inside and out."

Beneath aircraft No. 8648—United's identifying number for this particular 747—mechanic Ken Silva, sporting a mischievous grin, rides a black-and-silver Schwinn Cruiser bicycle and munches an apple, sizing up the craft that will occupy his working hours for the

Paint crew applies yellow primer, turning No. 8648 into monster goldfish beneath sodium-vapor lamplight.

Photographs by Randall Hyman

Ken Norton of tire-changing crew shows one that was damaged when DC-8 brake locked during landing.

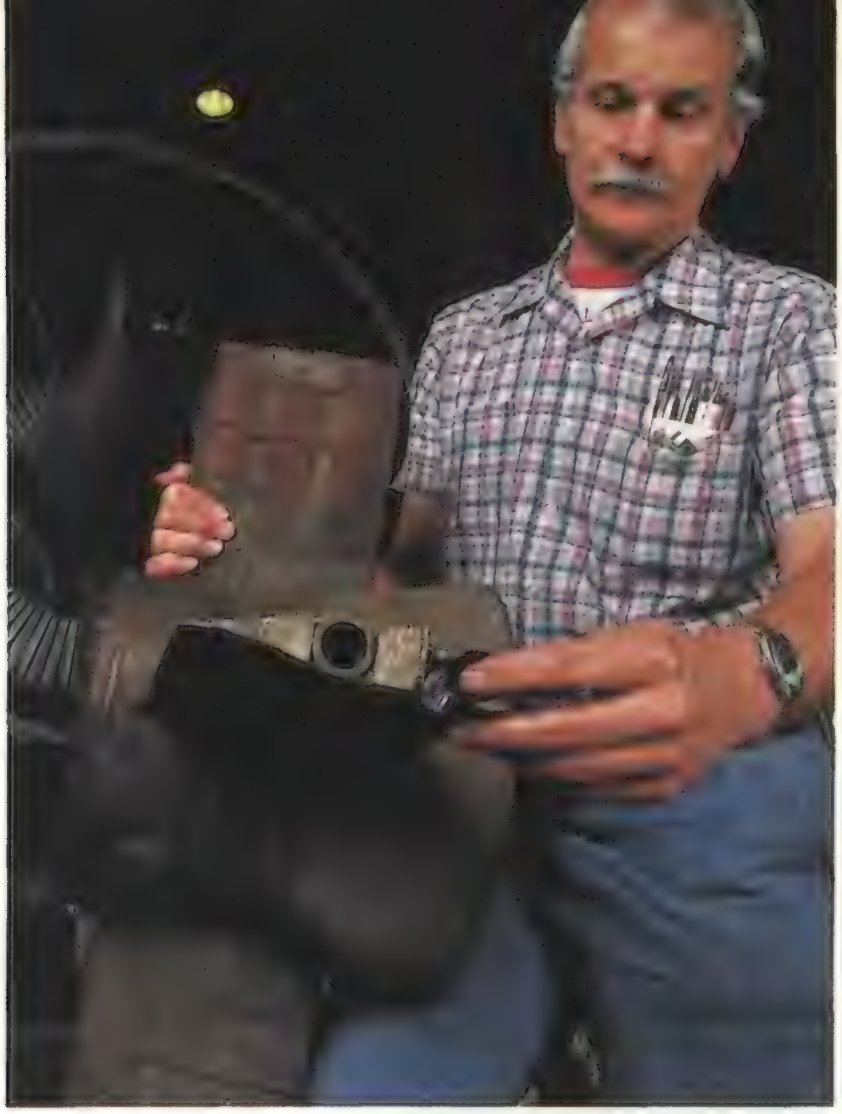
next three weeks. Robert Sanchez, safety inspector for the Federal Aviation Administration's San Francisco office, arrives to check the "blowing" of the slide-rafts, a test of the emergency evacuation system. Selecting two of the aircraft's doors at random, he glances at his watch and gives the high sign. Inside the plane, technicians yank open handles. Hissing like great yellow serpents, each 32-foot-long slide hurtles from its suitcase-size cocoon in the door, inflates and snakes to the ground. Detached at sea, these ungainly devices—never yet needed on a 747—can serve as life rafts for up to 64 people. Sanchez checks his stopwatch. "Six-point-six seconds," he proclaims, well below the 15-second time limit. "It's a pass."

No. 8648 is a marvel of engineering. As a 747SP (SP stands for Special Performance) the jumbo jet has been trimmed of excess fat, lightened, shortened and equipped with oversize tanks that hold nearly 50,000 gallons of jet-A fuel, the quantity needed to fly nonstop from New York to Tokyo—more than 8,000 miles, a third of the distance around the globe, 14 continuous hours in the air. At takeoff, the fuel alone weighs more than an entire DC-8. Its four turbofan engines churn out a total thrust of nearly 200,000 pounds. With a wingspan stretching two-thirds the length of a football field, a tail soaring higher than a six-story building, and a weight, fully-loaded, of almost 700,000 pounds, what's amazing is that the thing can fly at all. "It's black magic, really," jokes Silva.

Maintenance isn't the part of flying that airlines advertise. There are no slick spreads in travel magazines praising its virtues, no koala bear saying his airline does it best. Yet recently this aspect of the airline industry has found its way onto the front page. For as 1985 drew to a close, attention suddenly focused on what had been a nonglamorous, behind-the-scenes operation. A record 2,089 people worldwide died in crashes of scheduled and chartered flights in 1985; at least three of those disasters were maintenance related.

Investigation to date indicates the loss of 520 people aboard a Japan Air Lines 747 was due to the faulty repair of a bulkhead behind the pressurized passenger compartment. As a result, the bulkhead ruptured, releasing an explosive burst of air from the cabin that blew apart the tail. A deadly fire aboard a Boeing 737 in Manchester, England, claimed 54 lives when a faulty engine disintegrated on the runway. In Milwaukee, a Midwest Express DC-9 went down with 31 passengers and crew members when one engine came apart and the other lost power on takeoff.

In addition, there was a rash of maintenance-related "incidents" last year in which no one was hurt—luckily. In April, an American Airlines 727 had an engine tear loose high over New Mexico when struck by ice that formed outside the plane—ice caused by a leaky lavatory valve that should have been fixed, but wasn't. A few months later, a United DC-10 had to return to Washington, D.C., when pilots experienced control problems. The cause? A nut that was holding one of the stabilizers and shouldn't have come unscrewed, did. And then there was the American maintenance supervisor in Chicago who used an auto-parts spring for a critical flight-control repair. Why? Because the proper part was not available and he didn't want to delay the flight.



Inspector Dave Garvin holds a fairing sheared by turbine blades coming off JT8D engine (background).

Fractured sections of 747 fuselage frame that could cause decompression are examined by Brandon Maus.

Indeed, some observers believe that economic pressures brought on by deregulation of the airline industry in 1978 have caused serious lapses in maintenance standards. Poor maintenance, in a recent Harris Poll, was cited just behind hijacking and bombing as the area most worrisome to the flying public, and the FAA is getting tough. Over the past two years, it has temporarily or permanently grounded 52 airlines for noncompliance with safety measures.

Some analysts worry that the FAA may be stretched too thin, too underfunded to monitor everything it should. "In 1978 I had eight inspectors for 300 airplanes," says the FAA's Sanchez in San Francisco. "Now I have one inspector and myself for over 350 planes." More help is on the way for Sanchez and other inspectors, but he still feels it's not enough.

Other experts believe that the recent spate of accidents may actually make flying safer in the long run, noting that within months of the Japan Air Lines crash, inspectors checked the entire world fleet of 641 Boeing 747s, discovering—and replacing—a number of bulkhead bolts found to contain stress fractures.

There is no sign of cutting corners on No. 8648. All afternoon the 747 has been "prepped" like a surgical patient; mechanics like to work on clean equipment and they know that dirt can hide problems. As darkness falls, men in yellow slickers, helmets and face shields, using high-pressure hoses, wash layers of grime picked up in New York, Hong Kong, Taipei and Bangkok from the plane's landing gear and belly skin. The engines are so delicately balanced that the Pacific breeze wafting over the ramp turns them over, windmilling the seven-foot-two-inch-diameter fans in the cowlings with a clacking noise that sounds like giant wind chimes.

At 10:30 P.M., a squat, rubber-wheeled tractor called a "tug" hooks its boom to the nose landing gear of the aircraft. Warning bells sound and the huge hangar doors roll open. Inside, men with whistles stand at strategic locations like football referees, ready to gauge clearances to make sure that wings, engines or fuselage don't clip a stand or scaffold. It's an odd mixture of high and low tech, a gleaming, megabuck aircraft (747-SPs run $100 million a copy, new) guided in much the way a local cop directs traffic in a parking lot. The process is slow. It is nearing midnight when 8648 is finally berthed, the power outlets in the hangar floor hooked to its electrical and pneumatic umbilicals.

The towering aircraft, its characteristic bulge in the forward fuselage causing it to resemble a beached humpback whale, has company inside the hangar. In an adjoining dock, almost wingtip-to-wingtip, a DC-10

The d'Aulaires free-lance from their 200-year-old Redding, Connecticut, home. They spent three weeks at United's MOC facility covering this story.

jumbo nestles amid the movable catwalks and ladders of a mechanized dock that allow access from the top of the tail fin to the tip of the radome, the radar-antenna housing in the nose. It will be here for an overnight check, a comprehensive triannual checkup carried out on a different DC-10 almost daily. On the other side of the hangar, mechanics swarm like ants over a Flying Tigers 747 freighter, undergoing a "D-check," the highest level of maintenance, scheduled, roughly, when an aircraft reaches its ninth birthday. The freighter looks like a mammoth model kit being assembled by a child who hasn't figured out where all the parts go. Entire chunks of the plane are absent, sent to shops for rebuilding or replacing. Shiny new landing-gear assemblies stand nearby, awaiting installation on the legless metal bird. The interior is gutted, the cockpit a maze of wires hanging out of empty instrument sockets like high-tech spaghetti.

The work being done on 8648 is a major maintenance, designed to scrutinize about 1,500 individual components that need routine examination or replacement based on a computerized record of the aircraft's flying time, number of takeoffs and landings and the age of its individual parts. In addition, mechanics will fix any "unscheduled" problems that turn up—there will be another 1,500 or so of these. Says foreman Steve Blackwood, "I've been in this business 18 years and it still boggles my mind. We get an airplane all torn apart and then we somehow manage to put it back together."

The work can be emotionally taxing to the mechanics, who know that lives depend on how well they do their jobs. Says mechanic Don Shanks, who specializes in checking the cockpit controls and instruments, "Some of these guys wake up at night and ask themselves, 'Damn, did I forget something?' They'll call in at all hours to make sure. There's a lot of stress in this job, a lot of pressure to meet schedules."

DC-10 is enclosed by mechanized dock and movable scaffolding that allows easy access from tail fin to nose.

Seats removed, the interior of 8648 is spacious enough to hold a barn dance, though that wouldn't be wise since mechanics have opened up several of the lightweight, composite floor panels below now-discarded carpeting to check the structural members underneath. They have also stripped off wall and ceiling panels, exposing hydraulic lines and primary control cables over which they run soft cloths to check for frayed wires. Should any of the cables—linking cockpit controls to the electric, hydraulic and pneumatic motors that govern engine speeds, ailerons, spoilers,

Airplane is in United's MOC facility for a 24-hour comprehensive checkup that's done three times a year.

This examination takes place almost daily on a different DC-10 and is routine for working crews.

speed brakes, elevators, thrust reversers and the rudder —give out, the results could be catastrophic.

The seats that once filled the cabin are stacked in a corner of the hangar where they will be torn down to their frames and rebuilt with upholstery that has an upgraded fire rating, enabling them to withstand a 1,500-degree F flame from a blowtorch. Covers for the seats are being fashioned at the MOC's chair shop, and carpeting is custom-cut there from massive rolls.

Standing on a cherry picker, a propane-powered vehicle with a telescoping bucket that can reach 50 feet into the air, Ben Turner examines 8648's right front door. "There are about 20 things wrong with it," the 35-year-old inspector reports. "Loose bolts, bad bearings, seals, cracks. We're going to have to pull it off and send it to the door shop for repairs."

The 35 or so mechanics who work on 8648 each shift belong to two main specialties: radio-and-electric (R&E) and airframe-and-power-plant (A&P). In the easygoing bantering that's carried on in the hangars, the R&E people call their counterparts "knuckledraggers," in reference to the gorilla-like strength some-

Thomas Yasuda marks cracks that show up on an x ray of bearing-support diaphragm of a jet engine.

The wall and floor panels have been removed from 747 so frames, cables and wiring can be closely inspected.

times needed for the heavy mechanical work. A&P people retaliate with the epithet "twidgets" for the more delicate, fiddling type of work needed in the electronics end of things. Knuckledraggers repair engines, change landing gears, squeeze into access holes, crawl out on wings, fix corroded sheet metal. Twidgets tackle radars, check radios, batteries and autopilots.

Together they're like Lilliputians swarming over a tethered giant, poking, prodding, tweaking, measuring and testing until every inch of the 747 is examined. Each routine is printed out in advance by computer, describing, step by step, the exact procedures to be taken. In addition to the routine tasks come an avalanche of "nonroutine write-ups"—the unforeseen problems that surface as the plane is worked on. After each repair is done, the mechanic responsible must sign a job card stating that he has completed the task. Should something go wrong, the burden will fall on him. It could cost him his license—and his job. Not surprisingly, given the responsibility, there is a sense of brotherhood among the mechanics, be they knuckledraggers or twidgets. Ken Silva echoes their feelings. "Pilots are responsible for the passengers and the plane," he says, "But we're responsible for the passengers, the plane *and* the pilots."

There is a remarkable amount of individuality among the men and women working on 8648. Some sport preppy clothes and wear surgical gloves to keep the oil and grease off their hands. Others wear overalls and miner's lamps. Several eat, sleep and dream airplanes, like cockpit man Don Shanks. He pilots a single-engine Cessna and acts as flight engineer for the National Guard. "I'm one of those guys who can't get enough flying," he says.

Testing the fire-warning system next to him, 44-year-old Bob Burns, a burly Irishman who seems squeezed into the cockpit, laughs. "Not me. My idea of flying is sitting in first class with a gin and tonic. I'm going to stay on the job long enough to teach these new young mechanics how to fix planes so my gin won't spill." Meanwhile, Don Burda, who keeps tabs on the thousands of documents spawned by a major service check such as the one 8648 is undergoing, has won 17 national and international awards for his after-work job: acting as a clown. One mechanic moonlights as a choir director; another is a minister. Some are self-made millionaires, having hit it big in real estate and other investments; they arrive at work with the *Wall Street Journal* tucked under an arm.

Then there are the local entrepreneurs. "You can buy anything from caskets to Cadillacs in this place," says Ken Silva, who has opened his own improvised coffee shop in the hangar. When not working on jumbo jets, Silva, a knuckledragger, likes to visit art museums. His friend George Mann, a husky, white-bearded twidget who restores English and Italian motorcycles on the side, believes Wagner's "Ride of the Valkyries" should blare over the public-address system each time a stately jumbo, servicing completed and glistening with new paint, is pushed out of the hangar. "This,"

One of nine burner cans in a jet engine is examined for cracks that technician can see easily with naked eye.

he exclaims only half joking, "is the glory of aviation."

Why such worldliness among airline mechanics? Some cite the discounted travel. Others believe a special breed is drawn to the field, men and women willing to accept the tremendous responsibility their jobs entail. Though the pay is good, upward of $40,000 a year after half a decade on the job, money is not the only reward. "You get enormous satisfaction," says Mann, studying a thick book containing the wiring diagrams of a 747, "working on a machine so much larger than yourself—and then seeing it take off to fly halfway around the Earth. Don't forget, we fly too. The last thing we want is a plane falling out from under us." Adds Silva, "When I make a repair, I look at it as if I were the inspector. People's lives could be at stake. Besides," he adds with his usual sly smile, "my wife's a flight attendant for United, and she's not that well insured."

In spite of the occasional gallows humor, safety and the consequences of mistakes in the workplace are constantly on the mechanics' minds. Says Silva, "When I hear of an airplane going down, I first wonder, what carrier? Then, what kind of plane? Then, if it was United, was it a plane that I worked on?" Once a plane he worked on ran out of fuel over Portland and did crash. Silva did considerable soul searching.

In a system of checks and balances designed to lessen the chance of mistakes occurring in the hangar, inspectors—who report to a different department than do the mechanics—check and countersign each job write-up. Once the work is done, all paperwork is microfilmed and fed into a computer to become a permanent part of the airplane's history. "There's a lot riding on what these guys are doing," says maintenance foreman Frank Gilbride. "If something happens in the air, you don't just pull over to the side of the road."

Red warning lights flash. The mechanics stay clear of the plane as x-ray technicians expose 350 feet of film along the fuselage, looking for small cracks that are invisible to the naked eye. The search pays off. They find one of many broken bolts where the wing joins the fuselage, problems with the horizontal stabilizer, misaligned throttle levers. "We discover things we wish we hadn't," says Gilbride. "But that's what we're here for."

While Silva helps muscle one of four new 750-pound wheel trucks into place under the right wing of 8648, J. J. Gutierrez examines the internal parts of the left inboard engine for flaws or heat damage with a borescope. Derived from the proctoscope, a medical tool for examining a patient's lower digestive tract, the borescope is a fiber-optic device with a built-in light source. A pencil-thin viewer inserted into half-inch access holes placed around the engine gives Gutierrez a panoramic view of fuel nozzles, igniters, turbine blades and the combustion chamber. He can even read the serial numbers on individual parts deep within the machine. When internal damage is spotted, the engine is yanked from the plane and rebuilt, a 35-day process that costs upward of a half-million dollars.

Even "twidget" George Mann needs manual to repair disassembled spaghetti-like wiring of a 747 cockpit.

Because there is seldom any respite from the wind that streams across the tarmac, the doors of the hangar are usually kept shut. With no windows, there's a sense of timelessness inside where mechanics work around the clock under the yellowish light of sodium-vapor lamps. Most are seasoned employees who know what to look for. They know, for example, that because of metal fatigue that has been showing up in some 747s, they should check 8648 for stress cracks in the web frames and stringers—the circumferential and longitudinal structural members—just ahead of the forward door, between the windows and the floor of the first-class section. "In the first airplane we checked for this problem not too long ago, we found a member badly cracked," says Brandon Maus, an engineer and manager of technical services at the United facility.

When an airplane is at high altitude, it is literally inflated, pressurized internally to keep passengers comfortable in the thin atmosphere many miles up. If a large area of framework fails, the skin riveted to it loses its support and could tear apart in that area, resulting in sudden decompression as a tornado of cabin air rushes out the gap. Any nearby objects—passengers, service carts, even bolted-down seats—might be sucked out by the inexorable force. "We're taking apart every 747 we have to make sure that doesn't happen," says Maus. No. 8648 has no cracked frames. But it will be checked periodically to make sure it stays that way.

Another area receiving careful scrutiny is the belly skin of the aircraft. "You never know what you're going to find in the area beneath the cargo compartment," says sheet-metal mechanic Sam Piper. "One time a mechanic spotted a snake crawling around in the insulation down there. It took three days of chasing up and down the belly of the plane to catch it, and they never did figure out how it got there. More of a threat is mercury dripping from broken medical and scientific equipment; it can eat through the aluminum skin if not vacuumed up in time. "Then there are the lobsters," sighs Piper. "These planes carry a lot of lobsters—and that means saltwater corrosion in the hull." Vulnerable as a modern commercial jetliner may seem, David Fitzgerald of United's pilots' union says it's a "marvelous piece of machinery. It has fail-safe systems, backups after backups. To put an airplane like the 747 into a mountainside takes an awful lot of mistakes. They may look fragile when you take them apart, but they're not. Still," he adds, "you're never going to completely eliminate human error."

One of the most chilling close calls of recent times occurred because of human error at a maintenance facility. In 1983 an Eastern Airlines Lockheed L-1011, flying from Miami to Nassau in the Bahamas with 172 people on board, lost total power in all three engines at 12,000 feet. One had been shut down by the flight engineer when the oil pressure dropped. Then, shortly after, the other two just plain quit. With luck and skill, the flight crew restarted one of the three engines at 4,000 feet and limped safely back to Miami. Cause of the flameouts? Mechanics had failed to install a pair of three-quarter-inch-diameter O-rings—cousins of the much larger plastic seals that doomed the space shuttle Challenger—on the thumb-size magnetic probes that fit into each engine's oil system to trap metal particles that might signal undue engine wear. Without the rings, each engine's 15-quart oil supply quickly dribbled out. Two of the engines ran dry, overheated and seized. The one that restarted was the one that had been shut down at first and still had enough lubrication to make it back for an emergency landing—barely. A few more minutes and it, too, would have failed.

Always dealing with human-error factor

United has had its goofs too. Last February, for instance, a United DC-10 came to the MOC for an overnight-phase check. Working on the tail engine some 30 feet off the ground, a mechanic with 20 years' experience became distracted when a new worker called him over to ask for help. As a result, the older mechanic forgot to latch the 200-pound cowling around the engine.

Fortunately, as the plane loaded with passengers was still on its takeoff run, the air-traffic controller spotted the cowling billow open in the slipstream. He radioed the cockpit with an urgent warning. The pilot immediately slammed on the brakes and managed to stop the airplane.

Checking through the paper trail, the FAA's San-

chez quickly located the mechanic involved. "He could have had his license permanently yanked," says Sanchez, "but it was his first problem and the man took full responsibility, admitting that he had just plain goofed. That's the human-error factor that we're always dealing with."

The work being done on 8648 is not without its dangers. Crawling into fuel tanks to check for corrosion caused by algae, which surprisingly flourish in this environment, can be confining and claustrophobic. Even the room-size belly tanks of the SP must be entered through an access hole barely big enough for a mechanic to squeeze his hips through. In some of the smaller wing tanks, mechanics have to slide in head first. Once in, there is no turning around. "You have to slither back feet first," says swing-shift foreman Bill Estensen. "If you panic and tense up, you're going to get stuck; it happens even to the best mechanics, especially when the temperature in there shoots up to 130 degrees on a hot day." The only way out? A shot of a tranquilizer in the rear end to relax the victim sufficiently so he can be extricated safely.

No hazard is more feared, however, than getting caught on one of the flight-control surfaces—flaps or ailerons—while they're being tested. Operated by hydraulic pressure at 3,000 pounds per square inch, the flight controls move, often silently, with stealthy power that can crush a person into a flyspeck.

More than halfway through its "check," 8648 looks like a crippled condor, flaps drooping, wheels and even one engine removed ("borrowed" by another 747SP with a bad engine, in from Japan on a short turnaround schedule). Painters have masked the windows

Inspector J. J. Gutierrez uses borescope, a fiber-optic device, to take a close look inside 747 engine.

on 8648, preparing the aircraft for stripping so inspectors can check for corrosion on the aluminum skin. Wearing protective "moon suits," night-shift workers, riding cherry pickers and perched upon hoists suspended from the ceiling, spray the fuselage with hundreds of gallons of methylene chloride and concentrated formic acid—the same stuff ants use for chemical defense. The stench is overpowering; paint sloughs off in huge globs.

By the time the day shift arrives at 7 the next morning, 8648 is a shining, windowless aluminum hulk, looking more like a giant sardine can than a plane. Rubber snakes, stuffed owls and electronic noise devices are activated to try to keep the pigeons that have nested in the hangar from adding their own decorative touches to the aircraft. One area of the floor is studiously avoided. Someone has painted a sign on the concrete: "Pigeon Drop Zone."

Whenever another 747SP arrives at San Francisco and needs a spare part not immediately available from inventory, that part gets "robbed" from 8648, like the engine that went to the plane from Japan. As a result, the instrument panel is a sorry sight of missing dials and vacant sockets. "Spare parts are sometimes in short supply," explains foreman Blackwood. "The 'borrowing' is necessary to stay one step ahead of the game. Everything gets put back or replaced eventually."

Nearly three weeks have gone by since 8648 first came in and the stack of job cards has visibly shrunk. The pace quickens dramatically as the deadline for releasing the plane nears. Mechanics bolt a newly refurbished engine into place, replacing the one that was borrowed. The rebuilt engine has been run in a test-

After an unexpected engine repair, Scott Finger quickly closes the cowling so flight won't be delayed.

cell process so reliable that no test flight will be necessary. Overnight, a finish coat of white, orange, red and blue—90 gallons of polyurethane paint—is sprayed onto 8648. New four-foot-high tubeless tires go on the landing gear, eight wheels on a side, two under the nose. Engineers and mechanics double-check some of the 191,000 microfilmed parts diagrams for the SP to make sure they have missed nothing.

Inside the plane, carpeting has been installed and mechanics bolt the refurbished seats to their tracks in the floor and adjust them. They hook up the wiring for flight-attendant call buttons and reading lights. From speakers in the ceiling, "elevator" music pours forth. Now 8648 slowly comes to life, her rudders and flaps moving as mechanics complete final checks.

The very last of the almost 3,000 job cards and non-routine write-ups is signed off, the repairs approved by the inspectors. For the first time in three weeks, fuel is pumped into the 747's tanks. A mechanic makes sure the tires are all equally filled; compressed nitrogen, not air, is used since air collects moisture. A tug attaches its boom to the nose gear, the hangar's great doors open and the plane is pushed backward, slowly, out of the giant building onto the ramp. It's one of those moments when George Mann wants them to play "Ride of the Valkyries."

In 8648's cockpit 35 feet above the ground, Remo Lanfranchi, a mechanic who specializes in taxiing airplanes, ignites the engines one by one after the tug unhooks. From up front, the roar of the jet power plants is barely perceptible. He sets the altitude gauge to sea level and taps it twice to make sure it is not sticking; then, receiving clearance from the airport control tower, he taxis across the runways to a waiting gate.

It is June 3, 1986. United aircraft No. 8648, operated as Flight 835, lumbers down the runway at San Francisco International Airport and, at 1:06 P.M., arcs smoothly into the sky, destination Taipei and Bangkok. None of the 153 passengers aboard could guess that 14,703 man-hours and some $2.5 million have just gone into their aircraft.

Meanwhile, outside the huge hangar, just in from Hong Kong, the next 747 due for a checkup is parked on the ramp, already robbed of relays, artificial-horizon indicators, autopilot and other assorted hardware cannibalized to help speed 8648's departure. Ken Silva rides his Schwinn Cruiser over to have a look. Then the doors rumble open and a tug hooks up to tow the newcomer into the hangar. Inside, mechanics cluster around their toolboxes, ready to start all over again.

Working on a cherry picker 35 feet off the ground, knuckledraggers remove lightning-damaged rudder.

It's a tight fit for this mechanic who is inspecting the elevator-control system in tail section of a DC-8.

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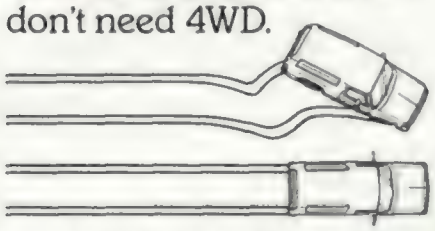

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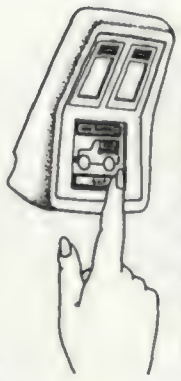

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*Based on SAE Standard J1349.
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Bronco II four-wheel drive

Bronco II two-wheel drive

Ford

By Meryle Secrest

The tumultuous life and love of Salvador Dali

Salvador Dali Museum, St. Petersburg, Florida

Self-portrait from student days shows suave young Spaniard with "an eye that hears inner sounds."

Now in his 80s, the artist has found rich fulfillment in the Teatro-Museo that he has created in the Spanish town of his birth

In the summer of 1918 when he was just 14 years old, a precocious Spaniard, Salvador Felipe Jacinto Dalí y Domènech, had his first public exhibition of paintings at the municipal theater of his birthplace, a small town in Catalonia near the French border.

More than half a century later, the world-famous artist presided at the opening ceremonies of a museum devoted to his genius in his home town of Figueras, in the province of Gerona, in that selfsame theater, now transformed into the Teatro-Museo Dali.

The fact that the original showcase for his works should become their final resting place and, in addition, that such a museum should happen to be situated in the shadow of the ancient church in which he was baptized, was no coincidence. For the grand old man of Surrealism, now 82, Spain's preeminent national treasure since the deaths of Picasso and Miró, was returning to his origins.

Today a virtual recluse, Dali has settled into the museum that has become the focus of his life. Not long ago I had the rare opportunity to visit the artist there in his apartment in the old tower, the Torre Galatea, adjacent to the Teatro-Museo. In the dozen years since his museum opened in 1974, its popularity has become so firmly established that it is now the second most visited museum in Spain after the Prado. In 1985, attendance was 318,764. The concomitant boost to tourism is not lost on the town's elders, who have made no secret of their hopes that Dali will leave his remaining holdings of paintings, drawings and objects to the Teatro-Museo in his will.

"Because of Dali, thousands of people come to Figueras who never would have heard of us," said Mayor Mariano Lorca. Ramon Guardiola, a former mayor, now a prominent lawyer, the man most responsible for guiding the museum's course past many bureaucratic reefs, said, "Dali is a rare phenomenon. Imagine! With just three simple props—a pair of rolling eyes, a mustache and a cane—he has astonished the world."

The prodigy exhibited more paintings in the municipal theater of Figueras some six months later, in January 1919, and attracted even more respectful admiration. A local critic observed that here was a great artistic talent and prophesied a glorious future. It was gratifying, but one has the impression that the artist never for a moment doubted it. There is no question that Dali had already demonstrated great singleness of purpose and such undeniable gifts that his father, a respected, well-to-do member of the middle class and a notary by profession, was forced to jettison his hopes that his only son would follow him into the law, and allow him to study art in Madrid instead. Dali is sometimes depicted as a young genius who was hampered by conventional parents lacking in artistic sensibility. In fact, however, his mother and grandmother loved to paint and draw, while his father was a man of wide reading and interests. One of Dali senior's

A 1979 photograph evokes Dali's declaration of 45 years earlier in Hartford: "The only difference between myself and a madman is that I am not mad."

Gala and Dali relax during 1974 museum installation. The pair had a long and close working relationship.

Mae West apartment in Teatro-Museo is trompe l'oeil triumph. Famous mouth is sofa, eyes are pictures.

closest friends was a Pitxot, a member of a remarkably gifted family of artists and musicians, who were his neighbors in Cadaqués, the fishing village on the Costa Brava where he had been born and where he had a summer home. Thanks to the Pitxots, his son received an early education in the artistic styles then in vogue, as well as spirited encouragement.

By early manhood, Dali was investigating every artistic style of the day, from Cubism and Futurism to Purism. The meticulous care with which he approached his chosen field was in pointed contrast to the readiness with which he challenged his teachers. He was twice expelled from the academy in Madrid where he had gone to study art, leaving without ever attaining a diploma. He was, in short, a quintessential dropout, with the hair and wardrobe to match. At the same time, he was a leading spirit of a band of young Spanish intellectuals that included the future filmmaker Luis Buñuel and the poet Federico García Lorca. By then Dali was writing essays, poems, critical analyses and stories as well as painting. His canvases explored what would become themes of a lifetime: the landscape of the Costa Brava and, specifically, the streets and harbor of Cadaqués and the nearby inlet of Port Lligat, where he would eventually buy a house.

Then in 1927-28 Dali painted *Cenicitas* (*Little Cinders*), Surrealist figures in a dream landscape, a painting precursory to the richly productive period (roughly 1929-39) in which he created his finest works. These canvases portrayed with the utmost intensity the haunting images for which Dali would become famous: the soft watches, crutches, grasshoppers and egg-shaped objects, among others, that are his artistic trademarks. Dali seemed to have a dual gift, remarkable as it is rare, of making contact with his unconscious fantasies and, at the same time, analyzing them with uncanny precision. He wrote lengthy treatises to explain what he called his paranoiac-critical method—that is to say, the way in which he could transform the world of outer appearances to reflect his inner world of fantasy and dream.

Dali already knew that his gift for histrionics—he describes, in his autobiography, the way he used to fling himself down a flight of steps to gain the admiration of his schoolmates—masked intense feelings of insecurity. These were coupled with severe sexual phobias. There were deep-seated family tensions that led to frequent battles between father and son. The summer of 1929, when he met Gala, the great love of his life, marked, by no coincidence, a decisive break with his family.

When Dali met Gala, a fascinating, enigmatic figure who left Russia shortly after the Revolution began, she was married to the French Surrealist poet Paul Eluard. The Eluards and their nine-year-old daughter, Cécile, went to Cadaqués the next summer to visit Dali; the poet and his daughter departed alone. Dali has given Gala credit for providing him with a disciplined and tranquil framework within which he was able to mature as an artist. There is no doubt that she mothered him, supplied vital emotional support, regularized his finances, became his business manager and acted as an indefatigable assistant and publicist.

There were some years of financial hardship although, by most standards, remarkably few. By 1934 Dali was becoming internationally known. In 1936, when he was just 32 years old, his face appeared on the cover of *Time* magazine. The antic acts which had become characteristic were now being used with greater calculation, once he realized their public-relations value. One of his first stunts, at an international exhibition of Surrealism in London in 1936, almost cost him his life. He decided to give a lecture on the unconscious in a diving suit, which was novel enough, but then, after several incoherent minutes and some frantic gestures, his audience realized that the lecturer

Meryle Secrest's newest book, Salvador Dali, *will be published next month by Dutton. She wrote about Bath, England, for* SMITHSONIAN, *November 1984.*

"Rainy Taxi" in courtyard is descendant of car from 1938 Paris Exposition. On hood stands *Queen Esther.*

Lincoln in Dali Vision attracts young visitors. At a distance, nude painting of Gala turns into Lincoln.

Grand old man of Surrealism

was suffocating. He was freed just before he fainted.

That flamboyant act was followed by another spectacular incident in the spring of 1939. Dali had been engaged by Bonwit Teller in New York to design two windows for the store and had personally arranged the objects, working late one evening. When he returned the next morning to admire his handiwork, he was outraged to discover that the scenes had been substantially altered. Most people would have lodged a spirited protest and left in a huff. Dali appears to have thought the matter over with his usual cool insouciance and acted with great deliberation. One of the props was a fur-lined bathtub full of water. He proceeded to enter the window and tip the bathtub's contents out. The bathtub slipped, crashed through the window onto Fifth Avenue and he, remarkably unscathed, jumped out. The exhibition of his work that opened a few days later was a great success.

By then Dali had already made a successful and highly publicized debut as a filmmaker with *Un Chien andalou* (Paris, 1929), produced in cooperation with Buñuel. This silent film, only 17 minutes long, is justly famous for having broken with what was then the trend of avant-garde cinema. Buñuel himself is seen in the opening sequence testing a razor on his thumbnail. The audience is then treated to the sight of an eye being slit by a razor, and to other images of more or less explicit menace, accompanied by an Argentine tango and music from *Tristan und Isolde*. The film naturally provoked violent reactions. It seemed bent upon offending the viewer's sense of what was right and proper, yet its images were undeniably powerful. *Un Chien andalou* marked the beginning of a distinguished career for Buñuel and provided an ideal showcase for Dali, which he exploited with alacrity.

Before long, he was designing hats and clothes for Schiaparelli, ballet sets and costumes for the Ballets Russes, writing poems, organizing balls, holding exhibitions in New York, Paris and London, and beginning to investigate the highly lucrative world of advertising. He was wined and dined in Europe and, after he and Gala fled to New York in 1940, was equally feted there. He painted portraits of the wealthy, worked on more ballets, designed for Alfred Hitchcock (his film *Spellbound* made notable use of Dali's dream landscapes), arranged his own exhibition at the 1939 World's Fair and wrote and wrote: essays, articles, poems, manifestos, an autobiography, his first novel.

His mastery of the art of self-promotion became legendary. His collaborations with photographers, notably Philippe Halsman, are object lessons in how to turn a single prop—in this case, his increasingly exaggerated mustache—into a cause célèbre (opposite). He perfected the art of the interview-as-performance.

Shortly after the outbreak of World War II, Dali announced that he was abandoning Surrealism. Having made a career, as it were, out of rebellion, one might have predicted that he would reject the reigning international movement, abstract art. More and more painters might lose their way; he, Dali, intended to usher in a new classicism. His themes, he said, would be inspired by the nuclear age and Christian iconography.

A proliferation of unlimited editions

The paintings that followed—including *Dematerialization near the Nose of Nero* (1947), *Leda Atomica* (1949) and his famous and controversial rendering of *The Last Supper* (1950), now at the National Gallery of Art in Washington—while masterfully composed and painted, seemed detached, even calculated, and lacking the emotional tensions that had given his prewar canvases such a jolting impact. He was also turning more and more to book illustrations and prints, executing thousands of quick studies in watercolor, gouache, pencil and inks. These were in such demand that, over a period of years, Dali allowed himself to be persuaded that the procedures commonly followed by artists in the making of prints—the printing of a limited edition under the supervision of the artist, the inspection of the results, the final signing and numbering by the artist himself—need not be scrupulously observed. The end result has been the proliferation of unlimited editions that Dali never touched or approved of before the sale. The impact of this on the art world has been enormous. Michael Ward Stout, Dali's New York lawyer, believes that $625 million worth of unauthorized Dali prints have been sold in the United States in the past few years.

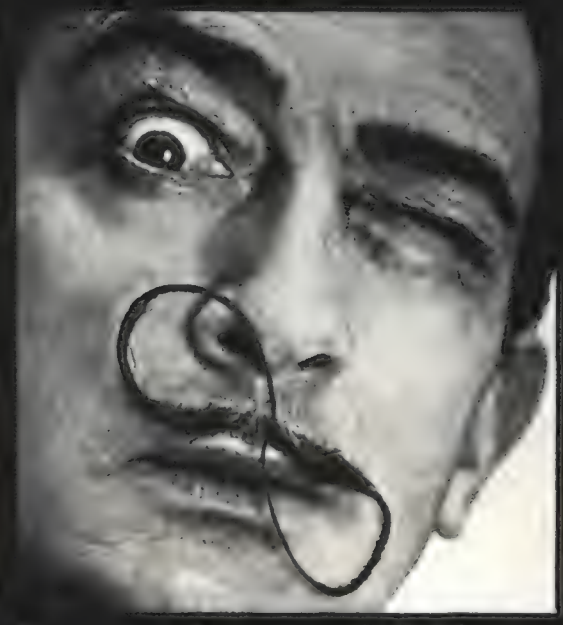
The situation has been exacerbated by Dali's admission that, from 1964 onward, he sometimes signed blank sheets on which his publishers would print

Have you evolved a definite style? "No, I am completely mobile."

Is your mustache on the defensive? "No, it is often offensive."

What would reveal a raging bull hidden in you? "Swiss cheese."

Have you been psychoanalyzed? "No analyst could take me lying down."



How often have you tried? "A gentleman never discusses figures."

How do you get such superb detail in your painting? "Nature gave me my best tools."

Dali's mustache was the subject of a 1954 book in collaboration with photographer Philippe Halsman. Above, some excerpts from their interview: the answers in quotes are Dali's. Mustache is real thing.

commissioned images. Later, sheets with forged signatures were sold for $40 each. Peter Moore, a former associate, now claims that, over a 20-year-period, Dali signed a total of 350,000 blank sheets. Stout believes the figure is much less, perhaps 40,000. "There must be tens of millions of forged signatures floating around now," says collector A. Reynolds Morse. To make the job of the forger easier, Dali's signature has varied markedly over the decades. Moore has published a slim volume in which he purports to have identified 678 different examples of a genuine Dali signature. Dali has now stated that he has not signed any blanks since December 1979, when his health deteriorated. The assumption is that prints dated since then can be rejected out of hand.

Perhaps the showman-promoter has eclipsed the artist, despite three immense retrospective exhibitions of his works that were well received critically and attracted immense crowds: in Paris (1979), London (1980) and Madrid (1983). Paradoxically, the establishment of his museum, which should have led to a serious reassessment, has not laid the matter to rest. The criticism is frequently heard that Dali's best paintings, such as his famous *The Persistence of Memory* (1931), for instance, or his ravishing *Metamorphosis of Narcissus* (1936-37; pp. 68, 69), are either in public collections or in the Salvador Dali Museum in St. Petersburg, Florida, which houses the splendid collection assembled by Mr. and Mrs. Morse, his indefatigable admirers. Exactly what great works may still be in

Museum of Modern Art

The Persistence of Memory (1931) shows Dali's most famous image, the soft watches. The painting, which is said to be a meditation on the relativity of space and time, gave Americans their first taste of Surrealism.

the artist's possession and their eventual destination remain unanswered questions.

In addition, there is a further group of 92 paintings, executed in an 18-month period, 1981-83, which forms the most controversial part of his legacy. It is claimed that the aging artist could not possibly have painted so many in such a relatively short time. Dali's old friend, the photographer and art historian Robert Descharnes, who is now his principal spokesman and has written many books about him, said that under Dali's supervision, many of these canvases were prepared by Isidor Bea, a Barcelona artist who has acted as his assistant for many years. However, Descharnes insists these are "true works by Dali."

The late 1970s were sad and difficult years for the artist. Gala, who had protected her husband (they were married in 1934) from the world for so many decades, was growing old and tired (she was nine years his senior) and spent much of her time in her own country house at Pubol, some miles distant from Port Lligat, to which Dali might not go without a written invitation. There were reports of quarrels, recriminations and even blows between Gala and Dali, and abrupt departures from their court of associates.

Dali was being treated for depression and periodic refusal to eat. Then, in 1982, Gala died at the age of 87, and Dali went to pieces. He moved into Gala's country house at Pubol, refused to see his old friends and stopped eating altogether. This time, the complicated mechanism of what he called "autopunition"—self punishment—was reactivated with a vengeance. He dwindled to 98 pounds and seemed bound to die, when he was suddenly revivified by the worldwide fuss over his 80th birthday, on May 11, 1984. He began to eat. He took renewed interest in his museum and, as soon as he was strong enough, went to visit. It became the remaining passion of his life. Then, two months later, he was struck down by a new disaster. A freak fire, caused by a short circuit in his bedroom, resulted in burns requiring skin grafts.

The thick feeding tube that has kept Dali alive since the accident provides a daily menu of pureed proteins, carbohydrates, vitamins and minerals. He has gained weight and looks far different from the pathetic figure in a wheelchair that was seen on television as he was taken from the Barcelona clinic to live within the walls of his beloved museum in the Torre Galatea. My visit there one evening came at the end of a tiring day.

Tate Gallery, London

The Metamorphosis of Narcissus (1937) contrasts golden figure of Narcissus with ossified hand holding an egg from which a flower emerges. Dali wrote a poem that interprets the myth and his own rendering of it.

The interview was arranged by Robert Descharnes and astounded those who hold the view that Dali is being isolated from his friends by his closest associates —Descharnes, the Spanish lawyer Miguel Domènech and Antonio Pitxot, a member of the family that Dali has known all his life, who is also an artist. My interview did take months of negotiation and, following my arrival in Figueras, a further week of waiting. Two appointments were made and then canceled because the master was indisposed.

The consummate practitioner of the interview-as-performance had not lost his touch. He sat in an elegant, airy, light room with windows overlooking a terrace, sparsely furnished with a bed, bookcase and a few chairs. He was dressed in something white and flowing, white socks and sandals, his feet resting on a low footstool and his elbows on white slipcovers. As I stammered out the *politesses* I had memorized, his face was impassive. He said nothing. In fact he never seemed to look at me. Pitxot was acting as interpreter, something I noted with gratitude as it became clear that the grotesque tube spouting from Dali's nose and descending his throat made articulation difficult. I knew that Pitxot came every night and stayed until the great man, having been fed dinner, was sleepy. Only then would he be allowed to leave.

I was directed to sit on Dali's right and registered confused impressions of the famous mustache, once so exaggerated and now quite subdued. He seemed intensely fatigued. That thought was an effort could be deduced from his right hand, which banged the armchair whenever he groped for a word. There was something dreamlike about the uncanny stillness of the figure in the white chair and the gargled sounds which began to give shape to what were clearly well-considered responses. The museum, he said, ought to be seen as an immense Surrealist object containing a secret language describing all kinds of enigmas, yet with a logic of its own.

He talked of himself in the third person, as usual. He seemed to want to cut short questions requiring a detailed response, whether out of fatigue or boredom I could not tell. Several questions drew no response from him at all, and I was despairing of finding a way to bring that motionless profile to life when he offered a thought for the first time. "You know," he said, "I am a better writer than I am a painter." With this I agreed. I had brought with me a rare copy of his poem to

Showman extraordinaire, Dali plays Dali at his Port Lligat home, where he lived until Gala's death.

accompany *The Metamorphosis of Narcissus*, with its marvelous photograph of Gala on the cover. He looked at it without comment and, I thought, without emotion. But then he ended the interview. As I turned to go, I saw his face suddenly alive with feeling, almost overwhelmed by pain.

The museum the crowds come to see was built in the 19th century in the Italianate manner, with neo-Palladian detailing and a second-floor balcony that had been the open-air setting for Dali's first exhibition. Although surrounded by courtyards on two sides, it is, nevertheless, largely hidden from the street by the walls of the old church, which cast long shadows on its facade. The museum has the aspect of "a ready-made," something which both Dali and Marcel Duchamp thoroughly appreciated.

The museum is seldom far from the artist's mind. Every two or three days he wants a full report on the numbers of visitors. When I was there, the courtyards were full of what seemed to be blond Scandinavians wearing shorts, cropped hair and exhausted expressions. Some slumped against the wall or draped themselves across tables, drinking Cokes to the accompaniment of deafening rock music. There were bicycles, backpacks, barefoot children in strollers, one green garbage can overflowing with bottles and plastic cups.

It all seemed to add to the general air of the museum as a theater of the absurd. Dali has been quoted as saying "There is this terrible phrase of Le Corbusier, 'A machine for living.' Architecture ought rather to furnish machines for dreaming." He has called his museum a "kinetic Sainte-Chapelle," and also said "Since everything about me is theatrical, I couldn't make a better choice." Among the museum's assortment of oddities is a *Cybernetic Princess* (1974), made from computer circuits and inspired by an ancient Chinese jade mummy; a bidet from a brothel once supposedly frequented by Edward VII; and a taxi inside which it will rain when five pesetas are fed into a slot. Tucked away in rooms behind the main displays are early and late works by Dali, including one of his most glowing portraits of his wife, *Galarina*, painted in 1945. Such fanciful, if not freakish, appositions, along with the lack of a guidebook—the artist has consistently refused to allow one to be published, on the theory that the public must arrive at its own conclusions—and the minimal labeling of exhibits, adds to the general befuddlement. Laura Cervera, secretary to the administrator, said, "Most people think he is crazy. They come here expecting to see strange things and go out no wiser than they came in."

Knowing that Dali considered himself a twin—an imaginative, rather than a literal truth, since his identically named brother died nine months before he was born—might set the informed viewer off in search of references to Castor and Pollux, to double, triple and quadruple images. One would soon discover numerous examples, such as a portrait of Dali painting a portrait of Gala seated facing a mirror watching Dali painting.

A room that looks like Mae West

Aware of his weakness for trompe l'oeil, one might expect to find some masterful renditions and not be disappointed. Among the biggest crowd pleasers is a room, arranged with a mantel, sofa and pictures; at a certain distance the pictures become eyes, the mantel a nose, the sofa a mouth, and the whole the unmistakable features of Mae West (p. 64). This is the artist, after all, who built a cabinet to hide an unsightly radiator in his wife's house in Pubol, then decorated it with the painting of a radiator.

At the Teatro-Museo one would discover Dali as art historian, the admirer of Vermeer, Velázquez and Michelangelo and of such 19th-century figures as Bouguereau and the largely forgotten Mariano Fortuny. One might, however, have to be something of a Dali historian to know that his *Rainy Taxi* is descended from the

"Rainy Taxi" he designed for the Paris International Exhibition of Surrealism in 1938. What is more, the car, an ancient Cadillac, used to belong to him. "As Dali tells it, the Cadillac is one of the first five or six made," Descharnes said. "Others were sold to Roosevelt and Al Capone. It's a great story, but I don't think it is true because Capone was in prison at the time."

One can hardly ignore repeated references to Gala as wife, model, lover, ideal. Dali's signature alone would make clear the debt he felt he owed: he frequently signed Gala Salvador Dali. There are many images of her, from the frankly realistic and tender to that of Gala as a malevolent figure, her eyes rolling—no doubt a reference to Paul Eluard's comment that here was a glance that could pierce walls. Or there is Gala as mortal being wooed by a god, a Leda with her swan, or Gala as a maternal, if detached, Madonna figure. And then there is the only music Dali will allow to be played, over and over again: "Isolde's Love Death" from Wagner's *Tristan und Isolde*.

In the main salon, underneath his portrait of Gala, Dali has placed a Roman bust of a young male in a gilded helmet and armor on a pedestal, with wings reminiscent of the Victory of Samothrace. At the other end of the room hangs an early self-portrait, with long sideburns, and beneath this is a delicate miniature painting of the road to Gala's house in Pubol. As Dali likes to say, quoting another of his heroes, St. John of the Cross, "The things we see are not to be found in the exterior world, but in our souls."

Perhaps the pièce de résistance is the brilliant ceiling Dali painted for the Grand Salon (below). It shows Gala and Dali as if standing on a glass floor. Their soles are firmly planted and their heads disappearing into the clouds. Around the edges are ranged numerous objects and scenes identifiable to any student of Dali's work—elephants on stilts, for instance, or a procession of men and women going toward a dark door cut in the chest of an enigmatic figure. Central to the theme are the twin portraits of Gala and Dali, ascending toward heaven and throwing a shower of golden coins. According to Dali, the coins represent the return of the wealth generated by the Teatro-Museo Dali to the people of Figueras, the artist's birthplace. Three of the coins, it is said, are genuine; but from that distance, it is impossible to tell which ones.

Extravagant ceiling of the Teatro-Museo's Grand Salon has twin portraits of Gala and Dali (on right) ascending toward heaven. Last summer an average of 3,000 people paid a visit to the museum every day.

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By John E. Pfeiffer

Cro-Magnon hunters were really us, working out strategies for survival

A new show in New York gathers the weapons, implements and art objects of Ice Age Europe, marking the appearance of doubly-wise humans

Life at the edge of glaciers in southwestern France, 8 A.M. on an early April morning, 12,986 B.C. Inside a moss-covered hut, one of a half-dozen clustered in snow between the foot of a high limestone cliff and a willow-lined stream, people are stirring in bearskin bedding. An old woman rekindles the fire that has dwindled to embers during the night and prepares a piping-hot potion, the prehistoric equivalent of coffee: grease broth consisting of reindeer fat afloat in a bowl of boiling water and tasting something like unseasoned beef bouillon. A welcome pick-me-up. Springtime temperatures hover around zero.

Another dawn, another awakening, another day. Hating to get up in the morning is nothing new. It is, and was, part of the human condition. Those people in France 15,000 years ago were us, only their lives were more difficult. A trial by ice marked the rise of modern human beings in the West.

Full-fledged members of the breed fondly referred to as doubly wise *Homo sapiens sapiens* coped with millennia of bitter subarctic winters and flourished in the process. They represented not only a new species but something even more significant, an entirely new variety of evolution. The major force for change in all other species was and remains evolution by genetic mutation and natural selection, producing protective bony armor, fur, horns, claws and other built-in features. In us, change takes place predominantly, and at a spectacular rate, by invention and discovery, information passed on in ever-increasing amounts from generation to generation.

Culture with a vengeance came 35,000 to 10,000 years ago in Upper Paleolithic times, the latest and last phase of the Old Stone Age. The Neanderthals who had dominated the European scene for some 100,000 years vanished and were replaced by Cro-Magnon populations, people like ourselves in brain and body. Evidence for the transition has been accumulating during this century, particularly during the past few years, and much of it is on display in an exhibition, "Dark Caves, Bright Visions: Life in Ice Age Europe," opening this month at the American Museum of Natural History in New York.

A natural sequel to the museum's 1984 exhibition which featured bony evidence for a more ancient transition, fossil skulls documenting the passage from ape to human four to five million years ago (SMITHSONIAN, August 1984), this event presents the works of human hands, the largest collection of original Upper Paleolithic artifacts ever displayed in the United States. About 250 items—tools to make tools, weapons deadlier than any produced before, musical instruments, body ornaments, art objects—testify to the burst of technology that signaled the European debut of modern humans.

One of the most elaborate displays occupies center stage at the exhibition, a full-scale simulation of a hut excavated in the Ukraine southeast of Kiev at the junction of two Dnieper River tributaries. It stands about eight feet high and provides a cozy 150 square feet, about the size of a small bedroom. Part of a winter base camp dating back approximately 15,000 years, it includes an outer facing or retaining wall of stacked

An extended Cro-Magnon family starts the day with hot reindeer broth inside their skin dwelling. Some of the implements they use are shown in the details. Clockwise from the top are two needles, a sandstone palette and ocher crayons, an oil lamp and two flint perforators used for making holes in bone and wood.

Illustrations by Lloyd K. Townsend

mammoth bones and represents a major trend in human evolution, a trend that may have started in Neanderthal times or earlier. The people who built that hut were no longer full-time cave occupants, no longer content solely with ready-made dwellings, natural limestone caves. In a kind of declaration of independence, they were taking the first fateful steps toward making the world meet their own needs.

The camp, wide awake now, hums with activity. Two infants in hanging reindeer-skin cradles dangle from the ceiling of one hut, where women have rolled back the communal bedding and tidied the area around the hearth. They are repairing reindeer-skin tents for the summer, patching and lacing up holes with fiber thread and bone needles. Outside at a shallow place in the stream, the ice has buckled under the upthrust of rushing waters, forming a "blister" several feet high. There are fish here under thin ice, easy catching for youths equipped with barbed spears.

The menfolk sit apart in the sun, as temperatures slowly rise above zero. One toolmaker is striking long, narrow blades off a cylindrical flint core with a bone punch and hammerstone; another shapes slivers of bone into spear points on a sandstone polisher; still another is using a flint burin or engraving tool to put finishing touches on two embracing ibexes carved opposite the hooked end of an antler spear thrower. The usual talk goes on about the weather, past hunts, obstreperous adolescents. But there is tension in the air. Every now and then someone looks up from his work to the trail winding up over the hills across the valley. Three men are missing—two brothers and their cousin—more than a day overdue from a hunting trip, and that could mean trouble.

New tools and weapons imply the emergence of new purposes, enduring signs of what Randall White of New York University, guest curator of the exhibition, calls "strategies for survival." In addition to items on loan from a dozen European museums and universities, archaeologist White has done some digging through dusty storage boxes in American museums and rediscovered many important artifacts excavated decades ago and never displayed since. The people who fashioned these and other enduring items were, *are*, our kind. They were us.

Our origins are somehow linked with the fate of the Neanderthals, a point emphasized by Erik Trinkaus of the University of New Mexico. We have never been proud of our extinct predecessors, partly because of their looks. They had heavy brow ridges, jutting teeth and jaws, a sloping forehead and broad nose—rather unattractive to some, although most of us would take them for granted in a restaurant today.

Randall White

The cave a quarter of the way down this cliff and the rock shelter to the left of the 16th-century fortress were occupied from the Ice Age into historical times.

The Neanderthals represent a high point in the human story. Their lineage traces back to the earliest members of the genus *Homo*, erect-walking toolmakers with brains about half as large as ours who arose two million years ago in Africa and stayed there for another half-million years. Then the gradual expansion began. Over thousands of years people moved out of Africa by way of the Near East into India and China and Malaysia, and into southern Europe. Only in relatively recent times, 150,000 or so years ago, did they spread to glacial landscapes.

The Neanderthals were the first to cope with climates hospitable only to woolly mammoths, reindeer and other cold-adapted species. According to Trinkaus, in the beginning they probably came during the

John Pfeiffer has made the study of human evolution his life's work. His most recent book, The Creative Explosion, *covers the same period as this article.*

The site is Reignac, in the Vézère Valley of France. The shelters at lower right cover recent excavations by Alain Roussot of the Musée d'Aquitaine, Bordeaux.

spring, competing with wolves and other predators for easy kills of newly born calves, and stayed on through the summer when midday temperatures often topped 90 degrees (although sundown could bring periods of freezing). Only later did they take on those terrible sub-zero winters.

There is no anatomical evidence that they were inferior to us cerebrally, and no doubt whatever that they were our physical superiors. Judging by their massive arm and leg bones, and general skeletal structure, their strongest individuals could probably lift weights of half a ton or so. Physically we are quite a comedown from them, puny by comparison. But what we have lost in strength we have more than made up in ingenuity.

Yet we replaced them during an overlapping period of a few thousand years, and gradually, not in one fell genocidal swoop. There may have been scattered local encounters in Europe, of course, but it was mainly a matter of attrition. Change at the Upper Paleolithic pace would have taken place only under intense pressure and, according to one theory, it was primarily population pressure. People were caught in a kind of climatic vise. Northern populations moved south as glaciers from Scandinavia advanced, while populations in African lands across the Mediterranean, ancestral Cro-Magnons, moved north—and everyone met in the middle, in southwestern Europe. The result: competition for subsistence, with the Neanderthals unable to meet the challenge and dying off in marginal areas. Perhaps they were too set in their ways. They vanished about 30,000 years ago, but anthropologists are divided on whether they were replaced by the Cro-Magnon species or evolved into it.

Learning to kill from a distance

During these times our ancestors developed an arsenal of weapons. While the Neanderthals apparently engaged their prey chiefly in direct combat, coming in close with knives and spears and clubs, their successors killed from a distance. They had the spear thrower, for example, capable of killing from a distance of 30 to 50 feet. The odds are that they also invented the bow and arrow, which may have doubled lethal ranges.

The newcomers developed an entirely different style of life. For one thing, toolmaking became considerably more sophisticated. The Neanderthals tended to be local-minded opportunists, relying mainly on flint sources close to home base, using a technique that yielded thick flakes and an estimated 40 inches of cutting edge per pound of flint. The Cro-Magnons were more selective, often obtaining special fine-grained and colorful flints from quarries as much as 250 miles away, and their punched-blade technique yielded 40 feet of cutting edge per pound. Furthermore, they improved on nature by heat-treating the material. They learned that flint raised to temperatures of 400 to 1,100 degrees F and cooled slowly becomes more elastic, easier to work.

For all their ingenuity, however, there were things that the people of the Upper Paleolithic could never make of flint. Needles, for example. They could probably have produced sufficiently fine flint splinters, but putting eyes in the needles would have been something else again. That called for a less-brittle raw material—bone or ivory. (The Neanderthals used little if any bone, confining themselves almost exclusively to stone.) The trick was to incise two deep parallel grooves in a suitable piece of bone, pry out the narrow strip between the grooves, shape it and then bore an eye hole with a tiny flint perforator—a process that Mark Newcomer of the Institute of Archaeology in London duplicates in three minutes flat.

It's a safe bet that people plied the world's first

needles to fashion "tailored" goods, warm form-fitting clothing. Patterns of beads on skeletons unearthed at an Upper Paleolithic burial northeast of Moscow outlined traces of decorated tunics, skin leggings and boots. Engraved limestone slabs show individuals dressed in parka-like garments and collared shirts complete with cuffs.

Needles began appearing in quantity 20,000 years ago at the height of the last Ice Age, and from then on technology took an extra spurt. The same period saw another advance recorded by the most fragile of evidence. Excavators found the carbonized remains of three plant fibers in a lump of clay at the bottom of a pit in Lascaux, the famous French wall-art cave. The fibers were braided into a rope or cord hinting at an entire complex of products: nets, fishing lines, thread, perhaps woven goods and baskets.

Alone and cold, tired and far from home fires, the missing hunters have stopped at the edge of a stream, preparing for one more crossing. They have little to show for their efforts. It has been a long, hard winter and meat is scarce. Their take consists of snared small game only: marmots, lemmings, Arctic squirrels and a young fox. Yesterday one of the brothers had a nasty fall, which meant a four-hour delay, a side trip to a first aid cache—a bag of bone needles and sinew, tourniquet equipment and medicinal herbs left months before in a special place just in case. Seven stitches close a gash in the victim's right leg.

Now the final stream must be crossed, naked. (Wet clothes would freeze solid to the hunters' bodies if they fell through the ice.) They strip and, holding garments and hunting gear and carcasses high over their heads, move step by step over the ice. Safe on the other side, they warm up by a fire, put their clothes back on and begin the last lap to home base, a 35-mile trek.

Hunters surround reindeer as they ford an icy river, when they are most vulnerable. Cro-Magnon bands could kill an entire herd. Their weapons included harpoons, like longest object at top left.

Recent reconstructions of subglacial life-styles, including those in the current exhibition as well as in this article, lean heavily on the observations of Lewis Binford of the University of New Mexico. He has spent months among the Inuit in Alaska's Brooks Range, endured one of their severest blizzards (seven feet of snow deposited in six days), and joined them in search of meat on the hoof. Conditions there are much more severe than those faced by the Cro-Magnons in the late Ice Age. Southwestern Europe was far more temperate and game was much more abundant and diverse. Yet the strategies of present-day hunter-gatherers, especially in regard to migrating food sources, whether they be caribou or reindeer, are very relevant.

It was carved from reindeer antler. The smaller ones, possibly fishhooks, were made from bird bone. Scrapers to flense hides are at top right while, at bottom, wild horses have been engraved on an antler baton.

Every day in early April in the Brooks Range, several parties are abroad miles and miles away from base camp, keeping tabs on their life-or-death food source—caribou, relatives of Old World reindeer. The herds will begin moving soon, almost certainly within five weeks and along traditional migration trails. But you are dead if you go solely by the odds. People have starved to death waiting for caribou that came by too late or took an unexpected route. Survival depends on hour-by-hour surveillance, always on the lookout for signs of where the herds are and where they are heading. Great clouds of steam, vapors produced by the collective breathing of thousands of caribou, may be seen at distances of 20 or more miles. As they come closer, you can hear them in the snowy silences, blowing and puffing like surfacing porpoises.

The worst rarely happens, but you must be ready. Scattered at 50 to 75 selected spots over a 10,000-square-mile terrain are a variety of hidden supplies—not only first aid caches (often located near bear dens) but also kayak caches, trapping caches with spring wood and cordage and other snare materials, fire caches containing tinder and flints and dried root wrapped around bones that will burn, caches of meat and fish.

These and other strategies have a long prehistory. Some Brooks Range rock piles have been used within the memories of local hunters; others represent sites dating back centuries. According to Binford, similar

Dots show some sites where the camps, tools and art of Cro-Magnon people have been discovered in Europe.

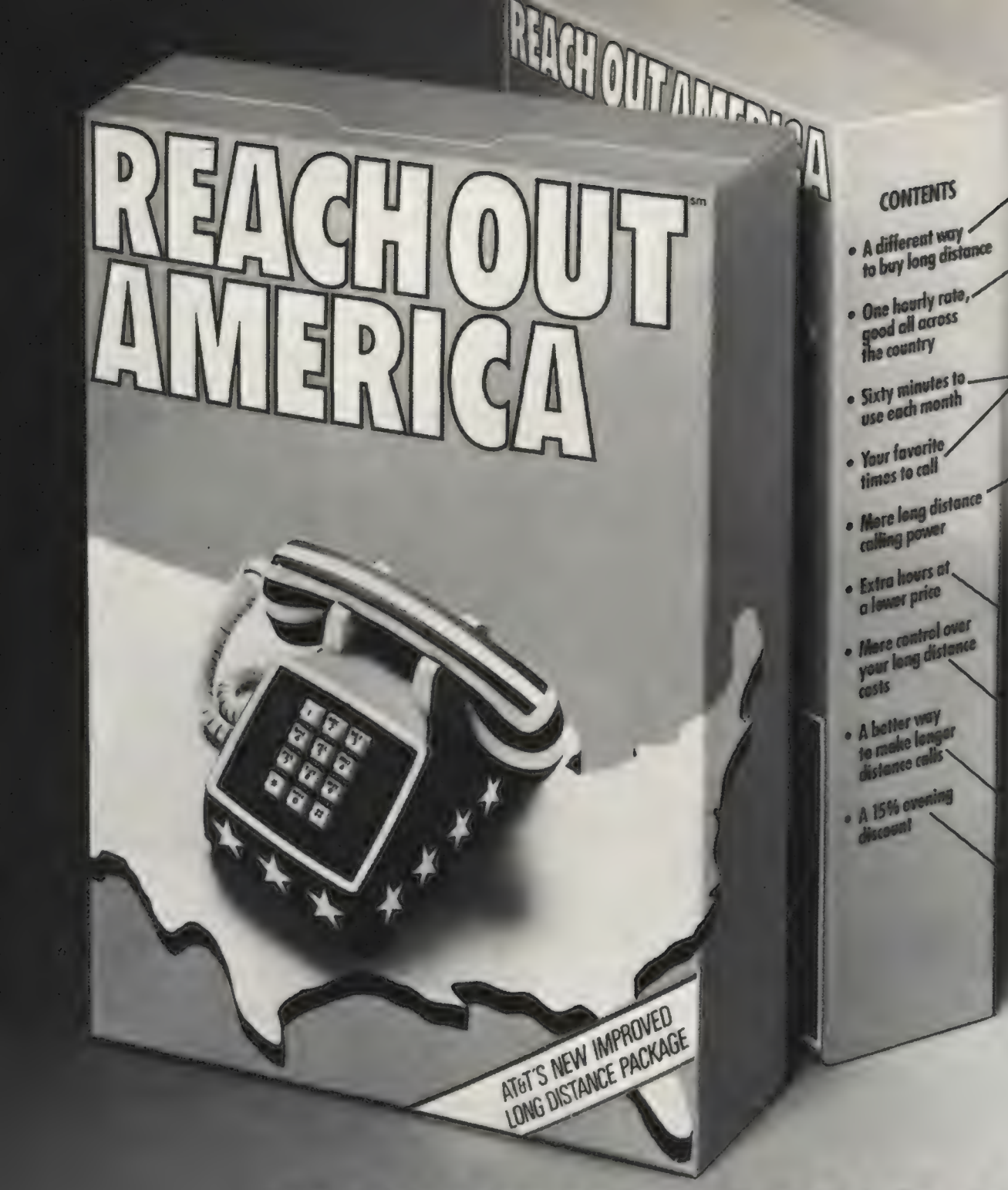
Great herds of grazing animals roamed the tundra, steppes and forests as the ice sheets began their retreat.

rock piles excavated in Europe probably served similar purposes. The living was not always easy, especially during early Upper Paleolithic times. Mary Ursula Brennan of New York University has examined dental remains 35,000 to 30,000 years old and reports frequent hollows in tooth enamel, sensitive indicators of starvation or gastroenteritis and other diseases often resulting from malnutrition.

But *Homo sapiens sapiens*, a minority species on the make, was becoming the most effective predator of all. Entire herds were ambushed at narrow passes or driven off cliffs. White mentions findings at Badegoule, an open-air site at the base of a 100-foot cliff in southern France: 340 pairs of antlers, 5,000 reindeer molar teeth, thousands of vertebrae and foot bones, and part of a mammoth skeleton in a huge fire pit. Other sites were located at river crossings along migration routes, near shallows and fords where reindeer could be slaughtered as they wallowed in the water.

The rise of mass hunting created an enormous gap between humans and the rest of the animal kingdom. As long as they behaved like lions and other carnivores, going after young and old and sick animals predominantly, they were playing a traditional role, weeding out the less fit, part of the ecological balance among living things. The large-scale game drives of the Upper Paleolithic changed all that. Late Ice Age hunters were capable now of wiping out entire herds, perhaps entire species.

As subsistence stress mounted, herd-monitoring groups moved farther and farther from their home bases, crossed the paths of other search parties and shared information with them as well as the spoils of successful game drives. It was a shift from local to re-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gional perspectives, people forming far-ranging social networks. Clive Gamble of the University of Southampton in England points out that the distribution of Venus figurines, stylized statuettes of women, hints at the extent of hunter-gatherer contacts. The figurines, represented by half a dozen originals at the exhibition, appeared 29,000 to 20,000 years ago when continental temperatures were plunging. Gamble identifies a "Venus zone" stretching more than 1,100 miles from the Ural Mountains to western France, hinting perhaps at an early fertility cult.

Bands keep to their territories

Individuals rarely if ever traveled that far, at least judging by the ways of recent hunter-gatherers. A typical living arrangement among the Inuit, as well as among the Kalahari bushmen, the Australian aboriginals and other groups, consists of a number of small bands. Each band stays pretty much within its own home territory, and collectively the bands form a viable reproductive unit of about 500 persons—that is, a population capable of replenishing its numbers.

Although the bands may be widely scattered most of the year, they need each other and come together on special occasions to arrange marriages outside the extended family and to conduct initiation ceremonies. If this life-style held for the Cro-Magnon, the Venus figurines found over large areas were probably passed from tribe to tribe, relay fashion. According to Olga Soffer, a University of Illinois archaeologist, the same pattern probably accounts for the distribution of furs, pelts, amber, shells and special flint blades throughout the central Russian plain.

Soffer also notes a change that broke with an age-old tradition. As far as we can tell from the record, until the Upper Paleolithic period hunter-gatherers lived by egalitarian principles with no official full-time leaders. Now with people coming together in larger groups and for longer periods, the times were ripe for men and women of rank to establish and enforce taboos, rules and regulations. This development is indicated by status burials, such as the one northeast of Moscow where two boys were laid to rest with valuable possessions, including mammoth-ivory spears, 8,000 ivory beads and assorted rings and anklets.

The jewelry heralds another basic change. It appeared out of the blue among people who had never before, in the 2,000,000-year history of the genus *Homo*, felt the need or the desire to ornament their bodies. The impression is that they were fighting back in a period of increasing social complexity and social control, expressing a new self-awareness. By enhancing their personal images, they were asserting themselves as social individuals.

Back at camp it's a gray afternoon, getting colder fast—and a happy shout comes from a girl watching on a rooftop. The overdue hunters are arriving home from the hills. Dead tired after walking eight hours without a break, they still cannot sleep. They are too wound up and besides, it is storytelling time. A score of relatives —men, women and children—gather to listen. A large herd has been spotted a day's journey away in Wolf Den Valley and will probably pass within ambush distance of camp in three weeks. The first signs, seen from afar high in the skies, were ravens scanning the ground below for meat scraps on the carcasses of reindeer killed by wolves.

The injured man is telling how he slipped on an icy slope and fell, sliding across a rock jutting up through the snow. His brother describes finding the first aid cache near Bear Power Creek, snow seen melting around the marker rocks, moose tracks noted on the way back, stitching up the wound. The men keep talking nonstop as if hypnotized, details pouring out of memory. No one says anything, but as they talk one of the older men in the circle around them engraves symbols on a piece of reindeer antler, memory aids for the details of the story. Three hours later they finish, and then come the questions and reminiscences about falling through ice, encounters with cave bears, the ways of reindeer and ravens and wolves, and on and on. Finally the hunters curl up in bearskins and sleep.

After every trip into the wilderness there is a time for the telling of tales, some of them tall, fact and legend mixed, recounted over and over again. The landscape is alive with remembered events at places identified by what happened there up to five or so generations ago. This is the oral tradition, the only way people without writing can preserve and pass on all they have learned, their technology and their beliefs. The poet Muriel Rukeyser spoke to the point: "The universe is made of stories, not atoms."

The best of Ice Age portable art

The Cro-Magnons had no writing. But they had symbols, notably in the form of art that came suddenly along with mass hunting and status and personal adornment. The New York exhibition spotlights portable art, figures engraved on pieces of antler, bone, limestone and ivory—among them a hunter taking aim at a wild ox, a mammoth engraved on mammoth tusk, and a bone item known as "amorous pursuits" showing on one side a man following a woman and, on the other, a male bison following a female bison. According to one theory, these are reminders of stories, pre-Aesop animal fables, perhaps, illustrations without books.

The final display takes you "underground" into a

WELL, THE GLENLIVET Scotch whisky does cost around $20.00. Which some say is a small price to pay for a Scotch which has been made in the same unique way since 1747. A 12-year-old single malt Scotch with a smoothness and unique character that is unsurpassed to this day. All of which could explain why people are so strangely possessive about The Glenlivet. Which is a pity. You might just have to buy a bottle of your own.

THE GLENLIVET. JUST SLIGHTLY OUT OF REACH.

darkened space, a cave setting with reproductions of impressive Upper Paleolithic works, the cave art. One rock wall features a portion of the "dead man scene" at the bottom of the Lascaux pit, a hunter apparently being killed by a wounded bison. There is also a replica of two beautifully molded clay bison preserved deep in a Pyrenean cave. The cave art may have been part of secret initiation ceremonies designed, like the portable art, to transmit the accumulating knowledge of the group, the primal encyclopedia, from generation to generation (SMITHSONIAN, April 1983).

White and other investigators believe that however the Neanderthals and their predecessors managed to communicate with one another, language as we know it was a phenomenon of Cro-Magnon times. Prehistoric ceremonies combined in a single social mix all the elements that later differentiated into separate institutions: art, religion, education, theater, libraries and archives.

The current effort is to rely less on inference and more on excavated evidence. Modern techniques demand that investigators dig at a painstaking pace, sometimes spending a day or more exposing prehistoric remains in an area of only a few square feet, recording the position of every piece of bone and stone. Sites as yet undug are archaeological treasure chests waiting to be opened. Grotte XVI, in the Dordogne region of France, consists of early, clearly stratified layers representing a span of 200,000 years and bracketing the crucial transition to the Upper Paleolithic. Jean-Philippe Rigaud of the University of Bordeaux and Jan Simek of the University of Tennessee are just beginning to excavate this cliffside cave in a four-year project designed to remove some 170 cubic yards of deposits.

The American Museum exhibition focuses above all on how suddenly it all came to pass, and how recently. Viewed in the light of the long, long stretch of previous prehistory, it was only yesterday that primates like us emerged from the human gene pool, a classical case of quantum-leap evolution. Indeed, we are practically their contemporaries, recent descendants of Ice Age people, still striving to devise strategies for survival.

Against the dramatic backdrop of a painted cave, a clan leader imparts the oral tradition of his people. Clockwise around them are some of the portable art objects, now being shown in New York, that helped them learn and remember it all: "illustrations without books." From top left are a Venus statuette, a spear thrower carved as a bison licking its flank, a profile of a horse's head, an engraving of a bison head, a horse sculpted in mammoth-tusk ivory and a necklace made of bear and lion teeth mixed with shells from the sea.

Above the Shader hallmark will be your doll's unique serial number – hand-painted in genuine 22kt gold.

Daisy's sumptuous black dress is highlighted by an eye-catching rhinestone and a strand of faux pearls.

Daisy's facial features are expertly painted by hand using a fine china paint. Her lifelike eyes are made of hand-painted crystal.

Each porcelain piece is individually signed and dated by the Shader craftsperson who made it.

Shown much smaller than actual size of 17″ in height.

Announcing one of the finest heirloom dolls ever produced in the United States...

D·A·I·S·Y

A ROARING TWENTIES BEAUTY

The Danbury Mint is pleased to announce *Daisy: A Roaring Twenties Beauty. Daisy* has sparkle, personality, sophistication and style! She steps straight from one of the most romantic and spirited eras of America's past: the Roaring Twenties. Now, *Daisy* personifies this era for all time, as a porcelain collector doll that will become a collector's classic!

Made in America by Shader's China Doll

Today, an American dollmaker is producing porcelain dolls of comparable or even superior quality to the coveted 19th century European classics. This dollmaker is Shader's China Doll. Shader dolls have quickly become legend amongst collectors.

Over 40 steps to produce each doll!

Daisy is crafted almost totally by hand. Consequently, it takes over 40 steps to produce each doll. In addition, after every painstaking step, the doll is carefully inspected. Shader craftspeople reject any doll for the least imperfection.

Authentic Flapper costume... hand-tailored of the finest fabrics

Every aspect of *Daisy's* attire is authentic. Even her bobbed hairstyle is true to the Roaring Twenties. Yet, *Daisy's* costume is totally original. This means there is no other doll who looks like *Daisy!*

Daisy wears black satin undergarments with white lace garters and stockings. Her black dress is hand-tailored in the low-waisted style of the period and her chiffon surplice bodice is accented at the neckline with sequins and tassels. Everything is hand-sewn!

Lavish special touches

An eye-catching *rhinestone button* at the left of *Daisy's* waist holds two pieces of chiffon that cascade towards the hem. The turban consists of tightly shirred chiffon and *two genuine turkey feathers* secured by a rhinestone button. *Daisy* wears a choker: *three rows of faux pearls* falling into a long strand. And she steps out in custom-designed shoes.

Each porcelain piece signed by the craftsperson who made it

Daisy is entirely crafted of fine bisque porcelain – head, arms, legs, body. Her face is an original sculpture.

Each piece is signed by the craftsperson who made it, attesting to your doll's authenticity. What's more, the head, arms, and legs articulate, allowing you to display your doll in various poses.

Hand-painted crystal eyes... coiffed by a registered beautician

Eyebrows, eyelashes, lips and nails are painted by hand and fired on to the porcelain for permanence. Next, hand-painted crystal eyes are added. Then, the doll is wigged and hand-styled by one of Shader's registered beauticians!

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Your doll's unique serial number will be hand-painted on the doll in genuine 22kt gold. Your doll will also come with her own display stand as well as a Certificate of Ownership.

A superb value

Since the Danbury Mint has made exclusive arrangements with Shader's China Doll, we can offer the doll for less than $250. What's more, you will be billed in convenient monthly installments of $49.50 each. Other all-porcelain dolls of similar quality are currently selling for hundreds of dollars more!

Satisfaction guaranteed

You need send no money now. To reserve your doll, simply return the Reservation Application.

Of course, your satisfaction is guaranteed. You may return your doll for a replacement or refund within 30 days.

Please act promptly

The sooner we receive your reservation, the sooner you receive your doll. *And the lower your individual serial number!*

Reserve your doll today!

RESERVATION APPLICATION

D·A·I·S·Y

A ROARING TWENTIES BEAUTY

The Danbury Mint
47 Richards Avenue
Norwalk, Conn. 06857

Please return promptly.

Please accept my reservation for *Daisy: A Roaring Twenties Beauty.* I understand the doll will be entirely crafted of fine bisque porcelain, artfully hand-painted, and authentically attired in a hand-tailored Flapper costume. Each porcelain part will be signed and dated by the craftsperson who made it. A display stand will be included at no additional charge.

I need send no money now. I will be billed prior to shipment for my deposit of $49.50; after shipment, I will be billed for the balance in four equal monthly installments of $49.50 each.* If I am not satisfied, I may return my doll within thirty days for a replacement or refund.

**Plus a total of $5 per doll for shipping and handling.*

Name _____
PLEASE PRINT CLEARLY

Address _____

City _____

State _____ Zip _____

☐ Check here if you want your deposit and each monthly installment charged to your: ☐ VISA ☐ MasterCard

_____
Credit Card No. Expiration Date

Signature _____

Allow 8 to 12 weeks after payment for shipment.

J-7

Photographs by Albert G. Richards

The secret hearts of flowers stand revealed in x rays

Using darkroom magic in a delicate process, a professor of radiography has found a way to see familiar blossoms in a whole new light

Venation in the petals of this cosmos takes on some abstract qualities associated with poster art.

Twenty-five years ago Albert G. Richards, out for a noon stroll in Ann Arbor, made a modest purchase that changed his life. A store was offering daffodils at 27 cents a dozen. Richards bought some and took them back to his office at the University of Michigan School of Dentistry, where he taught radiography to dental students and hygienists. On impulse he made a radiograph (x-ray picture) of one of the flowers, and thus began the hobby that led to hundreds of beautiful images like those on these pages.

"While many people love and appreciate flowers," he says, "they may never have realized or seen the secret beauty hidden within the blossoms."

Floral radiographs reveal details of the successive layers of tissue or petals. As you look at these pictures, you are looking into and right through the flowers. These images are perforce in black and white because there is no color at x-ray wavelengths. No shadows of the flowers are present in the radiographs that are comparable to shadows made by light in photographs.

In preparing flowers for radiography, Richards uses blotting paper to soak up rain or dewdrops. A tiny vacuum cleaner with probes like hypodermic needles sucks up any dirt lodged within the flower. Occasionally there are surprises: the radiograph of a rose revealed a spider and its nest deep inside the blossom.

Some plants appear shy about it all. They close up when taken into the cooler, darker room where the x-ray machine is, or they wilt during the exposure.

The most difficult part, Richards explains, is making a photographic print from the radiograph. The x-ray film has much wider latitude than does photographic paper, and he uses darkroom "magic" to go from one to the other without losing detail.

Richards says he was hired by the University of Michigan because he had made color prints in the 1930s and "knew something about photography." He has degrees in physics and chemical engineering, but not in dentistry. He was the first to use electron microscopy to view the internal microstructure of human teeth, and he invented the recessed cone x-ray head which is now standard equipment in many dental offices. He also developed an x-ray technique for obtaining fingerprints from badly burned bodies. In 1974 he was appointed to the first Distinguished Professorship in the School of Dentistry. Retired and given emeritus status by the university in 1982, Richards devotes himself to gardening and his basement laboratory.

Seven of his floral radiographs are at the Hunt Institute for Botanical Documentation at Carnegie-Mellon University in Pittsburgh. And one is in the collection of the J. Paul Getty Museum in Malibu, California. Richards' image was one of more than 100 flower photographs from the Getty's holdings shown in an exhibit organized last year by the Detroit Institute of Arts.

The stamens of two fuchsias emerge from multiple layers of petals and sepals that form the blossom.

A hidden bouquet

These ethereal images were chosen from 2,000 made over 25 years. The flowers can be cut or potted, and are simply placed between x-ray source and film. They are not harmed, and no chemicals are used.

Tulip (*Tulipa* "Darwin" hybrid)

Star magnolia (*Magnolia stellata*)

Iris (*Iris* Bearded hybrid)

Columbine (*Aquilegia* "McKenna" hybrid)

Campanula (*Campanula medium*)

Inside the flowing, cloaklike spathe of a calla lily, minuscule flowers can be seen at the base of the central spike.

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Somewhere, deep in your mind, is a child who grew up with dreams of adventure and romance.

A child who could turn a toy boat into a sailing ship. And a bathtub into the bounding main.

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And take you back to some of the most beautiful times of your life.

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3186
LOVEYJOANN

By Jon Krakauer

A fishing frenzy strikes on Sitka when herring run

Biologist Bob DeJong meets with fishermen during week when he can start the season on two-hour notice.

Because roe sells for $27 a pound in Japan, fishermen pull out all the stops in a season that lasts for only three hours and ten minutes

A herring is a small, nondescript fish that by itself is not much to talk about. Herring, however, may well be the most abundant species of fish in the sea, and a herring by itself is almost impossible to come by: its scientific name, *Clupea harengus*, is derived from an obscure German term meaning "army," a reference to the mind-boggling schools herring are wont to form —dense, silvery hordes that can stretch miles across and number hundreds of millions of fish. At one time the species was considered such a valuable resource that herring influenced world events to the extent petroleum does today. As early as the 13th century terrible wars were sparked by conflicting claims to North Atlantic herring grounds.

Alas, despite the species' profusion and historical significance, in this country herring no longer command a great deal of respect. The standard image of the fish here is that of a diminutive, oily species whose frequent habitat is a square tin with a key—a fish that, in the hierarchy of seafoods, occupies a station much nearer to sardines than to king salmon.

There are a few Americans, however, who think quite highly of herring, and Greg Johns is one of them. Johns, a graying Haida Indian who fishes commercially for herring each spring off the rocky shores of Sitka, Alaska, insists that herring is "one of the greatest fish in the world." At the moment Johns is sitting with a tall drink, watching the dusk descend on the Sitka harbor from the lounge of the Sheffield Hotel, and his glowing appraisal of the species might have something to do with the fact that earlier in the day he and his five-man crew landed 100 tons of the bright little fish the single time they set their net, a catch for which they will be paid approximately $120,000.

Actually, Johns and the crew of his handsome 58-foot wooden seiner, the *Deborah Ann*, netted closer to 400 tons of herring today all told: some 2.5 million fish worth a half-million dollars. The *Deborah Ann*'s crew, however, was able to pump only a hundred tons of this piscine booty out of their seine and into the holds of waiting tenders before they were forced to cut their net loose to keep the mass of eight-inch fish from pulling their stout boat beneath the waves. "The fish started running straight for the bottom," Johns recounts between sips, grinning and shaking his head, "and we couldn't stop them. The net went down, and then the boat started going over. The rail went under and there was water on deck halfway up the hatch coaming. When you see something like that happening, you don't hesitate. We cut the lines, the bridles—cut everything loose. Otherwise we would have gone to the bottom with the fish. Let me tell you, that was a *big* set."

Sitting at Johns' table in the Sheffield, offering congratulations for the fish he caught and commiseration for the ones that got away, are his colleagues Leo Woods, skipper of the *Yvonne Denise*, and Joe Demmert, skipper of the *Lovey Joann*. Woods and Demmert happen to be in high spirits tonight themselves, having each landed herring worth upward of $150,000 this morning. Lest one get the wrong impression, it should be pointed out that Johns, Woods and Demmert do not make this kind of money day in and day out. Indeed,

Trapped herring roil the water as the *Lovey Joann* hauls in a purse seine, a net that closes at the bottom.

Photographs by Terry Domico/Earth Images

Fishing boats and tenders spring for herring after being told that the annual madness is about to begin.

Most boats have spotters in planes overhead, but captains rely on echo sounders and their own instincts.

the 1986 Sitka herring "season" will end up lasting about as long as an extra-innings baseball game: a grand total of three hours and ten minutes, the first 50 minutes of which occurred today. Although the season is short, it can be exceedingly sweet: $6.5 million worth of herring, distributed lopsidedly among a fleet of 52 boats, was landed by the time those frantic 190 minutes of fishing came to a close. Working as a Sitka herring fisherman may have its drawbacks, but boredom on the job is not one of them.

How, it is reasonable to ask, can a fish that sells for 89 cents per tin in a typical American supermarket be worth such a fortune to a fisherman in Sitka? The answer is that it isn't: the herring one sees for sale in this country and throughout Europe are almost exclusively Atlantic herring. The flesh of the Pacific herring—the variety found off Sitka—is considered inferior and thus isn't harvested in any appreciable quantity for human consumption. The herring caught in Sitka Sound each spring are valuable not for their meat, but for the thick clusters of tiny golden eggs found in the female fish when they are ready to spawn.

Sitka herring fishermen would be out of work were it not for the custom the Japanese have of eating *kazunoko*—as herring roe is termed in that corner of the world—as part of their New Year's celebrations. The finger-length egg sacs are marinated in sweet *sake* and soy sauce and then served uncooked as *sushi*, artfully arranged with seaweed and a dollop of rice on a special ceremonial plate (p.104). Presented as only the Japanese can present food, it is an exquisite-looking dish, which is helpful, because eating *kazunoko* is a gustatory experience that has been accurately likened to chewing on salty rubber BBs. That, however, in no way seems to dampen the Japanese demand for the appetizer: dining on New Year's *kazunoko* (which is believed to increase fertility) is a tradition that's as strongly rooted in the Japanese culture as eating Thanksgiving turkey is in ours.

Undeterred by the fact that *kazunoko* retails in Japan for the equivalent of more than 27 American dollars per pound (hence *kazunoko*'s nickname, "yellow diamonds"), the Japanese consume 20 million pounds of it every year. More than a billion herring must be caught, just before they spawn, to supply this much *kazunoko*, and the vast majority of those fish are harvested off the Pacific coast of North America, herring having been fished to the point of extinction in Japanese waters.

Sitka Sound, located on the western shore of Baranof Island, halfway up the outside of the southeastern Alaska panhandle, is only one of some 20 sites along the North American coast from San Francisco Bay to northwestern Alaska's Norton Sound where herring are harvested commercially for their roe, but Sitka is among the most important, dramatic and lucrative of these fisheries.

The coming of the Sitka herring season is signaled

Seattle-based Jon Krakauer, who once worked on a salmon seiner in southeast Alaska, writes about the outdoors. This is his first article in SMITHSONIAN.

each March by the materialization of awesome congregations of herring up and down the Sitka shore, and by the appearance in Sitka harbor soon thereafter of an armada of fishing boats, tenders, freighters and behemoth floating fish processors from as far away as California and Japan. Although this fleet is 160 vessels strong, only 52 of these boats actually put nets in the water, that being the number of permits the Alaska Department of Fish and Game (ADF&G) has issued for the Sitka fishery in the interest of preventing Sitka's herring stocks from going the way of the once-mighty runs in Japan.

By the early 1960s, the Sitka Sound herring population had in fact nearly been decimated by overfishing. In 1977, to be better able to control the number of fish harvested each year, state authorities were forced to restrict the number of fishing boats that could participate in the fishery. The state became more conservative and, in 1979, the population rebounded. Then herring fishing took off.

At that time, lifelong permits were issued to those fishermen who could prove that they had regularly fished in Sitka Sound during prior herring seasons, and all others were banned from the fishery. The herring stocks had by then shrunk to the point where the ADF&G felt compelled to allow no commercial harvest at all in 1977 and only 250 tons to be taken in 1978. Initially, owning a Sitka herring permit was not much to crow about.

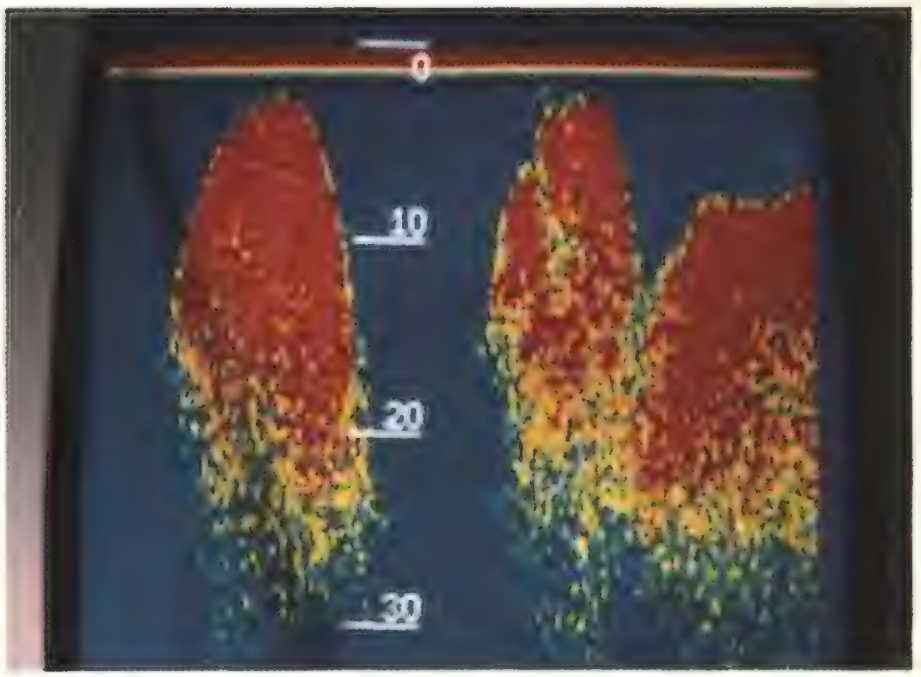
Permits suddenly worth a fortune

By 1985, however, the herring population had rebounded, prompting the ADF&G to up the quota to 7,500 tons, a catch that took exactly six hours and 55 minutes to land and, if split evenly among the fleet, would have earned each boat a cool $130,000. In reality, some boats made more than twice that much in 1985 and some made nearly nothing, but regardless of how many fish they caught, owners of Sitka herring permits suddenly found themselves being offered staggering sums—up to $210,000—for pieces of paper that had been given to them for a negligible registration fee eight years previously.

With so much money up for grabs over such a brief period, the Sitka herring industry has become a rather aggressive affair. These days, in fact, it more closely resembles an unholy cross between naval war exercises, a nautical demolition derby and an outrageously high-stakes poker game than conventional fishing.

In spite of Sitka's 19th-century heritage as a rich Russian fur-trading center and its association with the herring bonanzas of the past decade, this community of 8,000 doesn't really fit the rough-and-tumble Alaskan boomtown mold. In many ways, at least until those

In pilothouse of the *Pioneer*, Gerald Holmstrom and son Michael keep their eyes on the echo sounder.



False-color images on echo sounder show schools of herring. The redder the color, the denser the fish.

The high-powered skiff that helped set the net comes alongside as the net is pulled in tighter and tighter.

Frenzied fishing for Sitka herring

Working under cloud of gulls and the mountains of Sitka, fishing boats crowd the water over the herring.

infrequent moments when the rain clouds lift to reveal the raw, rugged, unmistakably Alaskan landscape encroaching hard upon the margins of the city, Sitka could almost pass for a mild-mannered exurb of Portland or Seattle. The town boasts sidewalks, paved streets, two colleges, a bowling alley, an internationally renowned classical-music festival, houses with neatly mowed lawns, bicycle paths and jogging trails—trappings of civilization that are seldom in evidence elsewhere in the 49th state. The local citizenry is proud of Sitka's upstanding demeanor and consequently greets the annual appearance of the rowdy out-of-town herring crews (fewer than a half-dozen of the 52 herring permits are owned by Sitka residents) with less than unbounded enthusiasm.

The herring boats show up every year just the same. In 1986 the first of the herring fleet pulled into Sitka harbor in mid-March, eager to take a crack at what the ADF&G announced would be a 5,029-ton quota, the third largest harvest since quotas had been imposed. The person responsible for opening the herring season and otherwise orchestrating the spectacle is a blond, 37-year-old man named Bob DeJong (p. 97), the Sitka Area Management Biologist for the ADF&G. DeJong's decision to kick things off will rest primarily on two criteria: when the roe has developed sufficiently in the female fish to fetch top price from the extremely discriminating Japanese buyers, and when the monolithic schools of herring have dispersed enough to make the fishing sufficiently difficult to ensure that the quota won't inadvertently be exceeded.

By March 28, roe samples taken from the herring schools milling just offshore look mature enough for DeJong to announce over local radio stations that the season is on "two-hour notice," meaning that he can henceforth open it at any time with as little as a two-hour warning. DeJong has to be able to start the action on such brief notice because in waiting for the roe to become as ripe as possible there is always the risk that the fish will suddenly "hit the beach" and spawn en masse before the season is opened. If the fishing doesn't commence immediately after such a spawn begins, the bulk of the herring might release their eggs before they can be caught, rendering them unmarketable.

Needless to say, DeJong is under considerable pressure. How much the Japanese will pay for the fish, as well as the future health of the fishery, hinges to a large degree on when and where he permits the fishing to occur. "I don't sleep too much this time of year," DeJong allows. "My stomach stays pretty tight. There's a little bit of money riding on this."

Four days after the fishermen have been put on two-hour notice, the season still hasn't opened. At watering holes like the Pioneer Bar, a one-pool-table establishment within spitting distance of the harbor, the tension in the smoky air is palpable. On April Fools' Day, in the daily permit-holders' meeting at the Sheffield Hotel, DeJong confesses to the standing-room-only assembly of clench-jawed fishermen that "we've got big fish and good, mature roe; right now these fish are at the highest maturity level you could get." The only

Collisions are frequent, and divers are carried to disentangle any nets that wrap around propellers.

reason he's still holding off, he says, is that the herring are "all bunched up and extremely vulnerable to overharvest. At this point there is no way we can fish and stay within the quota."

A day later the huge schools of fish lying in the sound a few miles out of town still haven't broken up, but DeJong believes the bulk of them are now in deep enough water to escape the fishermen's 90-foot-deep nets. Consequently, he surprises the crowd at the morning's meeting by announcing, "I feel it's time that we take some of these fish. . . . My recommendation is to start fishing right away this morning at 10:30." The fishing will be carefully monitored, he says, and when it looks like the quota is being approached there will be an announcement via VHF radio closing the season. Maps of the area that will be open for fishing are handed out and then chairs tumble and elbows fly as the fishermen scramble for the doors.

At 8:30, the *Pioneer*—a 68-foot, steel-hulled seine boat—casts off from the dock under a threatening sky with skipper Gerald Holmstrom at the helm (p. 99). Holmstrom is a soft-spoken, broad-beamed gentleman in his 50s with a permanent brown crust of Kodiak snuff on his lower lip and several days' accumulation of gray stubble on his chin. He has been in the thick of Alaskan fishing since he was three and has fished for herring for 33 years. A good percentage of the current crop of Alaska-herring and -salmon skippers got their start crewing on the back deck of one or another of Holmstrom's boats.

Putting the throttle down, it takes Holmstrom only a few minutes to reach the herring grounds, which are already bumper-to-bumper with all manner of watercraft, from a gaggle of motley vessels standing by to hold up nets sinking from the weight of too many fish, to a 200-foot tender waiting to empty the fishermen's nets. There are a dozen gun-toting game wardens, known locally as "fish cops," who will referee the contest from a squadron of speedy Boston Whalers; skiff-borne crews of Japanese technicians on hand to sample the herring in each seine for roe quality before the fish are taken out of the water; fully rigged backup seiners ready to come off the bench in case the first-string boats snag their nets on the bottom or break down.

Whales and eagles join the fray

Rounding out the cast of what is clearly going to be a very interesting show are scores of bald eagles, a blizzard of gulls, a small herd of sea lions and two humpback whales. Apparently unaware that DeJong has not yet opened the season, these finned, flippered and feathered participants are already fishing hard.

Overhead, two helicopters and 31 small airplanes hired by fishermen to locate schools of fish are buzzing in and out of the low clouds like a swarm of giant mosquitoes. Like virtually everyone else involved in the fishery, these fish spotters are working for a percentage of whatever their boats catch. Pilots associated with the seiners that do well can expect to see checks for $30,000 or more, but it is by no means easy money. Between the periodic snow squalls that ice up their wings and reduce visibility to zero, the 50-knot gusts and the crowded skies, fish spotting is a hazardous occupation. While there has yet to be a fatal crash during a Sitka herring season, there have been several midair collisions in other Alaskan herring fisheries.

For all the terrifying aerobatics the spotter planes are engaging in, the weather is so nasty it's doubtful they will be able to see much, so it appears that the skippers will have to find the fish today exclusively with sonar. Holmstrom has two different sonar rigs on the *Pioneer*, one that beeps insistently, like a loud video game, and another that shows clusters of herring as distinct green, yellow and red blobs—depending on the density of the school—on a television-size cathode-ray screen (p. 99). Seeing a flock of gulls feeding on the surface of the water, Holmstrom cruises slowly over to them and is rewarded by the appearance on the sonar

Overleaf: Racing boats and looping nets form chaotic scene. A seaplane used to spot fish is at left center.

Frenzied fishing for Sitka herring

The object of all the frantic fishing, the herring roe, is served as *kazunoko*, a traditional Japanese dish.

of a deep red streak that stretches clear across the screen. "Now *that*," he says, his blue eyes sparkling, "is a school of fish. A hell of a good school." Noting its location relative to the shore of nearby Middle Island, Holmstrom then casually motors out of the area in an attempt to avoid giving away the location of his find to the other boats in the area.

This ruse, sad to say, is executed in vain: the big school has already been located by a number of other boats. Although the boundary lines DeJong has drawn for this opening encompass three square miles of the sound, by 10:25—five minutes before the gun is due to go off—it becomes obvious that almost every boat has designs on one chunk or another of the same half-mile-long body of fish that Holmstrom intends to go after.

In the final minutes before the opening, the tension on the bridge of the *Pioneer* is almost unbearable. Four VHF radios (employed by Holmstrom to simultaneously listen to the ADF&G countdown, communicate with his spotter pilot and tenders, and eavesdrop on his rivals) are crackling over the frenzied beeping of the sonar. Everywhere boats are aggressively jockeying for position, trying to bluff and intimidate the competition to gain the best angle on the shifting mass of submerged herring. Five or six boats are rumored to be equipped with sophisticated jamming equipment to incapacitate the sonars of those around them. Tenders surreptitiously park themselves over schools of herring to screen off territory specifically for those seiners from which they will be receiving fish.

Holmstrom, as cool-headed a skipper as they come, is compulsively sucking down cup after cup of muddy coffee as he weaves the *Pioneer* through the tight slalom course of vessels. "We're going to have to watch the boat situation real careful," he remarks nervously to nobody in particular. "I don't want to get trapped or all tangled up. When the gun goes off I think I might just get out of the way, let the collisions happen and then come back in and scoop up the crumbs."

Starting in a cloud of blue smoke

At long last, just before 10:30, DeJong's voice comes over the VHF: "Stand by for countdown, ten, nine, eight. . . ." Putting a net in the water even a few seconds early can result in a $5,000 fine, a year in jail and the confiscation of herring worth hundreds of thousands of dollars, so every skipper in the fleet has his ear glued to the radio as DeJong ticks off the seconds. But with seven seconds to go, somebody breaks in on the channel over which DeJong is broadcasting, rendering the remainder of the countdown unintelligible. For a moment, many of the fishermen are reluctant to start fishing without hearing DeJong proclaim that the season is open, but then a boat called the *Nuka Point* guns

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CHARCOAL MELLOWED FOR SMOOTHNESS

The *Cape Reliant*, which does not have a license to fish, works as a tender for the *Defiant*, which does. Permits, which were issued for a nominal fee just nine years ago, are now worth as much as $210,000.

its engine and sets its net, initiating a chain reaction that fills the air with blue diesel smoke as the rest of the fleet follows suit.

The type of net used to catch herring in Sitka Sound, a purse seine, is a curtain of nylon web nearly a quarter-mile long, suspended on the ocean surface by a string of plastic "corks." To catch fish, one end of this curtain is pulled off the stern of the seiner by an 18-foot, 200-horsepower "power skiff" that tows the net in a broad circle around what will, it is fervently hoped, prove to be a school of herring. Once this circle is closed, a heavy line running through a series of rings attached to the bottom edge of the net is drawn tight like a purse string, trapping the fish in the seine.

Approximately 40 of the 52 seiners are attempting to set their nets in an area that will accommodate no more than 25 seines. In the ensuing melee boats carom off each other like billiard balls, nets are wound up in propellers, tempers reach critical mass, obscenities fill the air. After the smoke clears, Holmstrom steers the *Pioneer* into the fray, but wherever there are fish there isn't enough room to get a net out, and wherever there is room there are no fish. For 15 nerve-racking minutes, while fish are boiling in the nets of the boats around him, he races desperately around the grounds, fearing that DeJong will close the season before he can complete a single set.

Finally, as he maneuvers into a pocket of open water between three other seines, a broad yellow streak of herring appears on his sonar. "Now we're looking good," Holmstrom explains. "Get ready. . . . Let her go!" With that, the *Pioneer*'s power skiff races off from the stern in a wide, irregular circle, peeling the net off the seiner's deck with a clattering of corks. Three minutes later the circle is closed, Holmstrom winches in the purse line to cinch up the bottom of the net, and soon the black water within the corks is churning with iridescent fish. The net is then hauled on board with a hydraulic block until the fish are brought up tight alongside the boat and a suction pump is lowered into their midst. Fifty minutes into the season, as 60 tons of herring are vacuumed out of the seine and into the hold of Holmstrom's tender, DeJong comes on the radio to announce that the Sitka Sound fishery is officially closed.

That night the bars in town are packed with fishermen and spotter pilots either toasting rich hauls or attempting to ease the pain of poor ones. Twenty-one-year-old Dan Joosse is wandering around the streets wide-eyed, trying to walk off the adrenaline that is still surging through his veins. Joosse came to Sitka from Florida a week ago, flat broke but with dollar signs in his eyes, hoping to land a fishing job. He failed to find work on a seiner, but he did manage to get hired by a spotter pilot to ride shotgun in the cockpit to keep an eye out for other aircraft.

"You'd be circling above the boats with 18 or 19 other planes so close you could see their pilots blink,"

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A BLENDING OF ART AND MACHINE

Herring that survived the fishing have turned this bay white with milt, a promising sign of future fish.

Joosse relates, "and all of a sudden a snow squall would move in and the visibility would go to zero for two or three minutes at a crack. It was crazy, totally insane."

A seiner called *Reality* was the big winner for the day, landing 250 tons of herring. It is a catch that will be worth more than $20,000 to each of the *Reality*'s deckhands and at least five times that much to the skipper. There were boats like the *Deborah Ann*, of course, that netted even more fish than the *Reality* and then lost them, but the ones that got away weren't worth anything but a good story. Fred Haltiner, the skipper of a down-at-the-heels wooden seiner called the *Siren*, ended up with one such story.

The first time Haltiner set his net, the herring he was attempting to corral spooked and bolted before he could get the ends of his seine together. He noted where these fish were headed, though, and several minutes later with his sonar was able to find the massive school again as it lay under a group of tenders. "I had a hell of a time getting the tenders to get out of the way," Haltiner relates, "but I started screaming and yelling and calling on the radio and finally they moved." He set his net once more and by the time the skiff brought the end of the net around to close the circle, Haltiner was "jumping up and down like a little kid. I knew I had them."

Unfortunately he had too many of them: a school estimated by observers on nearby boats to be more than 400 tons. According to Haltiner, when he saw how many fish were in his net "it scared the hell out of me, my heart was going bang-bang-bang. If they all decided to go down at once I knew it was all over." With the *Siren* heeled over so far that much of the deck was submerged and herring were swimming in and out of the scuppers, Haltiner managed to hold on to the unruly mass of fish long enough to pump out 110 tons —then they sounded in earnest. Luckily the herring split the seine instead of pulling the *Siren* under. "There was a half-million dollars' worth of fish in there," Haltiner laments. "Oh well, it sure was fun to have had 'em for a little while."

Indeed. Especially considering that approximately 20 seiners never had any fish in their nets at all that day. It turns out that only two-thirds of the quota was taken before DeJong stopped the fishing, however, so these fishermen will have another chance.

They have to wait almost a week for the opportunity. Finally, on April 8, DeJong opens up the season again. To prevent the quota from being exceeded, though, he restricts the fishing to an area in the vicinity of the town ferry dock where there are not great concentrations of fish. Consequently it takes a whopping two hours and 20 minutes for the quota to be polished off and there are no net-splitting hauls of fish this time around. The greatest excitement during the day's fishing occurs when the *Malispina*, a 408-foot ocean-going ferry en route to Seattle, suddenly looms out of a snow squall to make its scheduled stop in Sitka.

The fishing over for the year, by the following morning most of the seiners that had been moored eight- and nine-deep at the town docks are nowhere to be seen—gone on the 3 A.M. tide. Happy to have their town back, Sitkans breathe a collective sigh of relief. But even as they congratulate themselves for having made it through another herring season without getting caught in the cross fire, 200 million herring are turning the sea a milky white with their spawn for 60 miles up and down the coast (left), ensuring that come next spring the Sitka herring derby will happen all over again.

Crewmen tighten the net still further before pumping out the fish. One successful haul can exceed 100 tons.

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By Richard Wolkomir

'Old Jearl' will do anything to stir an interest in physics

Jearl Walker doesn't believe in spoon-feeding science to college students; he counts on showmanship to make his classes palatable

At Cleveland State University, physicist Jearl Walker, an award-winning teacher whose classroom style is a blend of Mr. Wizard, Evel Knievel and *Saturday Night Live*, recently told the 200 or so students packed into one of his lectures: "What I'm going to do now is stick this spoon to my forehead." Then Walker, who is chairman of the university's physics department, breathed on a spoon and stuck it horizontally to his forehead. Staring owlishly at his tittering audience, he said: "This spoon sticks to my forehead because the molecules in the moisture on it are attracted to the molecules in my skin." He went on to explain that the spoon stayed suspended across his forehead like a metallic eyebrow because the torques that might rotate it were balanced out.

"Now I'll stick some more spoons to other parts of my face," Walker announced, blowing on yet another spoon, which he placed on one of his eye sockets. He put a third spoon on his other eye socket and then, as a coup de théâtre, he carefully hung a large soup ladle from the end of his nose. The students applauded. Twenty years hence, they probably will still remember what they had just learned about molecular adhesion and torque.

One of Ohio's largest public institutions of higher learning, Cleveland State University (CSU) is located in a central part of the city. Its 17,500 students are drawn primarily from middle-class and blue-collar homes within the northern half of the state. Physics, the science that deals with the interactions of matter and energy, has about as much appeal for many CSU students as an afternoon at the dentist's office. Jearl Walker, science teacher extraordinaire, makes the subject not only palatable but downright irresistible. His spoon trick is one of the mildest stunts in a spectacular pedagogical repertoire that features everything from walking on hot coals to plunging his bare hand into a pot of molten lead (p. 120).

But Walker, 41, is not just an entertainer. All of his science stunts are designed to make a point. "It's not difficult to understand physics, the way he teaches it," says Marty Pavelka, a senior from Brooklyn, Ohio. "He makes it so you're not afraid of it." That Walker is an educator of the first rank is reflected in the professional recognition he has received for his work, including a top award from the American Association of Physics Teachers in 1981 and his own university's Distinguished Faculty Award.

The keys to his success are a contagious enthusiasm for the everyday world of physics—which by his definition ranges from the optics of a rainbow to the dynamics of a flying dart—and a seemingly inexhaustible passion for teaching. He lists his occupation on his income tax returns as "Science Communicator," and rightly so. In addition to his heavy student load at CSU, he writes a widely read column called "The Amateur Scientist" in *Scientific American*, is an adviser to a children's science magazine published by the producers of television's *Sesame Street* and is the author of a physics text used around the world, *The Flying Circus of Physics with Answers*. He stars in an award-winning public-broadcasting series called *Kinetic Karnival* and pokes fun at scientific hubris in the Canadian Broadcasting Corporation's radio series *Quirks and Quarks*. Besides all of that, he also finds time to conduct workshops for secondary school teachers.

"He blows your mind with tricks"

At a time when college science programs are in a state of decline and science teachers are in increasingly short supply, Jearl Walker's special blend of scholarship and show business may suggest one way to help turn things around. "He blows your mind with tricks like lying on a bed of nails," says Ron Fabo, another CSU senior, from Wickliffe, Ohio, who plans to teach high school science. "I'll be stealing some of his stunts but the most important trick I'll be borrowing from him is to get the class involved, to go beyond the ordinary rote lecture."

Photographs by Richard Howard

Walker, a professor at Cleveland State, dons chef's hat and uses spoons to teach about molecular adhesion.

Professor Walker's 'flying circus'

Dressed as a samurai, Walker prepares to demonstrate how momentum of a karate blow can break a brick.

Sometimes Walker's methods of communication in the lecture hall are whimsical. For instance, in a semester's initial classes, devoted to the physics of work, students find their professor clad in Nike running shoes, corduroys and a T-shirt. That is his usual teaching uniform because his classes tend to require a great deal of heavy exercise. He is carrying a Winnie-the-Pooh doll. "Pooh has been with me ever since I was an undergraduate—and very lonely," he tells the class. "Now we're going to do a little work on Pooh." Hugging the doll, he runs off the podium, zigzags up the lecture hall aisle at full tilt, careens out the door, bangs his way up the stairs outside and reappears on the balcony suspended over the podium, still hugging Pooh and breathing hard. He then explains that, although he expended considerable kinetic energy running, the only energy that Pooh acquired was potential energy based on its elevation above the floor. To demonstrate exactly how much potential energy Pooh has accumulated, he drops the doll over the railing and watches implacably as it thumps onto the floor below. "Now Pooh's potential energy is back to zero," he says.

The students stared in horror

For another lecture—on gravity—early in the semester, Walker shuffled into the hall and shakily chalked a formula on the blackboard. Then he looked pathetically at the class. "I must apologize—I've been drinking too much again," he said weakly. "I guess it's because of personal problems at home, but I have some slides I want you to see, so please just ignore my condition." He rushed up the steps of the classroom's central aisle, wheezing and puffing as he clumsily loaded some slides into a projector, and began running back down the aisle toward the speaker's podium, carrying the rest of the slides in a box. Three steps from the bottom he tripped, flipped in the air and hit the floor with a thud, sending hundreds of slides clattering in all directions. The students stared in horror at their teacher lying there with his eyes closed. Then they heard a faint groan: "You're probably wondering why I fell." Tentatively, a few students giggled. "I fell because of gravitation, and I accelerated as I fell at the rate of 9.8 meters per second squared." The prostrate professor's arm slowly raised and his shaking finger pointed to the formula for gravitation that he had previously written on the blackboard.

Later, Walker told a visitor: "That's the breaking point in every class, because after that they realize I'm insane, and then they stop calling me Professor Walker and start calling me Jearl." Frequently he refers to himself as "Old Jearl," perhaps pausing in midsentence to gaze craftily at a formula he has just chalked on the board and saying, "Now that's just the kind of

At lakeside park, Walker uses the angular momentum of spinning wheel, held horizontally, to rotate stool.

Student helps Walker make point about distribution of stress, which is sufficient here to avoid injury.

tricky point Old Jearl is apt to put on a quiz, isn't it?"

When he finally rises from the floor after his fall, students are sure to listen as Walker explains that normally we remain upright because the floor exerts an electrical repulsion against our feet, a force equal and opposite to gravity. "That's why the world doesn't collapse and why we don't sink knee-deep into the floor," he says. "When I stand here, the electrical repulsion between the carpet molecules and the molecules in the soles of my shoes balances gravity, so the net force acting on me is zero until I trip, become airborne, with only gravity working on me, and accelerate toward the floor—crash!"

Walker's wild classroom style is based partly on his conviction that teachers are Davids battling the Goliath of television, and partly on his own exasperation when he was in high school and college. He grew up in Fort Worth, Texas, the son of a prominent lawyer. Today he is apt to exaggerate his Texas drawl and tell students, "Okay, I'm going to say that again, real slow, like we do in Texas."

Richard Wolkomir's experience with college physics was limited to one course in his freshman year, which he "hated"—but passed.

In high school he planned to be either a theologian or an existential philosopher. On his own he sampled the works of such cerebral authors as Kierkegaard, Dostoevsky, Karl Barth, Paul Tillich and Sartre. He also taught himself mathematics. "I was in love with mathematics," he recalls, adding, "I took a calculus course and I was overwhelmed with emotion because it was so beautiful." When he was a sophomore, he spent his Christmas vacation working out all the problems in the junior-year trigonometry text. At the beginning of the next year, he handed the trigonometry teacher the entire stack of finished problems and spent the rest of the year studying other things. In his quiet, intense way, he was rebellious. "I had trouble accepting statements from authority figures like my parents, teachers or preachers at the Southern Baptist Church I attended," he says. "I was always polite, but I questioned everything and wanted everything explained."

His academic troubles began when he went to the

Walker peers into kaleidoscopic mirrors held by his wife, Mary. He uses them to teach principles of optics.

Massachusetts Institute of Technology and discovered that he could not major in philosophy. "I messed up in physics the least, so I majored in that instead," he says. "No one seemed to care whether students like me learned or not and I was extremely lonely. It was the most dismal time of my life. It was almost like being in prison."

After graduating from MIT, he enrolled in the graduate program at the University of Maryland, aiming for a doctorate in astronomy. However, through a mix-up he found himself registered in the physics department and decided to stick it out. Then he became a graduate instructor and discovered that he loved teaching. But he was not very good at it; his classes kept falling asleep. One day, a student named Sharon asked him a good question: "Why doesn't physics have anything to do with my life?" Walker then realized that he himself had disliked college physics courses for the same reason—the lectures and the labs seemed disconnected from the world in which people live. "That night, for Sharon and myself, I began thinking of everyday things involving physics, like what produces a rainbow and why isn't the sky chartreuse," he explains.

His ruminations eventually became the *Flying Circus* text, which answers 619 questions such as "Why do the pipes sometimes groan and rumble when I turn on and off my water faucet?" and "What keeps a soap bubble together?" Walker had discovered that in trying to answer the simplest questions about ordinary things, you can delve as deeply as you want into the Universe's most profound mysteries. By then he had fallen in love with physics, but as a teacher he still considered himself a flop.

After earning his doctorate, he became an assistant professor at CSU. "My first year, I taught straight," he says. "I got along great with the students but I didn't feel I'd done a good job as a teacher." In his second year, he learned that instead of teaching small classes, he was going to have a big lecture. "I panicked. With so many students out there, I needed something to keep their attention."

As it happened, he was at that time reading an old textbook that talked about Leidenfrost's phenomenon, the principle that had enabled his grandmother to moisten her finger, then safely press it against an iron to see if it was hot. The moisture vaporizes and forms an insulating barrier between the hot metal and the finger. The text he was reading said that carnival performers used Leidenfrost's phenomenon to dip their moistened fingers into pots of molten lead at temperatures approaching 1,000 degrees F. "I tried it in a lab, with a student holding a first aid kit standing beside me," says Walker. "I was so scared I was shaking and I couldn't get my hand to actually dip into the pot." Finally, he stuck his finger into the hot lead and discovered that in real life as well as in theory, the laws of physics do work. Since then, wearing his chef's hat, Walker has plunged his hand into a pot of white-hot molten metal hundreds of times to demonstrate not only Leidenfrost's phenomenon, but also that simple stunts can convey physical principles to students more tellingly than arcane laboratory experiments.

Taking his cue from Peter Falk

Meanwhile, Walker felt that he was competing for students' attention with *Magnum, P. I.*, J. R. Ewing and all the entertainment razzmatazz of ABC, NBC and CBS. And so he began to study television with the same analytical attention he devoted to "Why are clouds white?" and "How do smoke rings form?" How, he wanted to know, do professional entertainers keep our attention? "I'd study shows like *Saturday Night Live*, trying to understand how humor works, developing a deadpan delivery," he says. "I'd see how Mary Tyler Moore made herself endearing by expressing vulnerability, throwing up her hands and stuttering. My old lecture notes would be dotted with 'MTMs' reminding me at a certain point in the lecture to throw up my hands, stutter and be endearingly vulnerable." He also borrowed the "Columbo turn" from the TV detective played by actor Peter Falk: he walks toward the blackboard, then abruptly stops, spins around and says to the class, "Oh, by the way." Having thus captured the students' attention, he then proceeds to make a key point.

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elaborating upon the everyday-life material in his own textbook, the plodding physics professor named Jearl Walker gradually transformed himself into Old Jearl, ace teacher and razzle-dazzle showman. Certainly by now he has become one of the most versatile performers on the American educational scene.

For classes on relativity, Walker has appeared in the gray mop and bushy mustache of Albert Einstein. Sometimes, to demonstrate the sonics of megaphones, he appears as a female cheerleader. Once his "long-lost love," who clearly no longer loved him, appeared at the door and "shot" the professor (with blanks, naturally) so that he could show how a struck body recoils. His "guest lecturer" for another lesson is a "samurai warrior" wearing a white karate outfit, his hair pulled up in a rubber band, and a "sword" (a large wire whisk) stuck in his green sash. In that guise, Walker explains how a moving object's momentum changes in a collision, becoming a force. To demonstrate, he cracks a brick with his bare hand (p. 114). A guest at one of Walker's classes on optics is his wife, Mary Golrick, although none of the students can see her since she is invisible. "Thanks for not laughing because Mary's a little different," Walker says deadpan. Then he goes on to explain that merely being transparent, like glass, is not invisibility because glass not only bends light but also creates reflections.

Walker packs so many calisthenics into his lectures on lasers that it resembles a Jane Fonda workout. He runs onto the podium and explains that in a laser, energized atoms emit photons of light. He drops to his knees and spreads his arms, becoming an atom emitting photons. Then he runs to the blackboard and executes a vigorous two-handed erasure. He chalks a formula for photon emission, drops to one knee and says a laser's trigger is an electric field, which he simulates by wriggling his fingers. Then he runs offstage, switches off the lights, runs back and pushes a button: a sharp helium-neon laser beam knifes across the room, zigging and zagging off reflectors, while the students exclaim, "Aah!" When the lights come back on, Walker, holding a can of Slice soda, starts toward the board, then does a Columbo turn. "Remember in our last lecture you guys were gasping in amazement at the awesome beauty of all the quantum numbers?" he asks. "I saw it in your eyes—you can't hide it. Would Old Jearl put that on a quiz?"

By the lecture's end Walker's green T-shirt is stained with perspiration from all of the exertion, but even so it has been a relatively easy class. Later that day, he lies shirtless on a bed of nails, with a second nail-studded board on his chest. "The question is, how much stress is on me from *each* nail?" he asks. "It turns out it's not *quite* enough to puncture me, only about a million newtons per square meter." Then he invites Linda Mancini, from Parma, Ohio, to stand atop the spiked board on his chest (p. 115).

In the same spirit, Walker used to stroll across a bed of hot coals, explaining to his spellbound students that nervousness makes the performer's feet sweat, creating a protective vapor barrier. The trick stopped working for him when he stopped getting nervous. He discovered that one day when he badly burned his feet.

Some of Walker's other stunts have backfired, too. Once, dipping his hand in molten lead, he caught some under a fingernail and suffered a severe burn. In another stunt he lies supine with a cinder block on his chest. With a sledgehammer, a helper smashes the block, which absorbs most of the force of the blow.

Between stunts, Walker ignores lectern and stays close to class. He borrows gestures from TV performers.

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After first wetting hand, Walker dips his fingers into molten lead. Vaporizing moisture serves as insulation.

When he tried using a small brick instead of a cinder block, Old Jearl was stunned for a long time thereafter. "I taught myself something about physics that time," he says ruefully.

Other stunts, while not downright risky, can be messy. Recently, Walker showed a class how the viscosity of certain fluids changes dramatically under stress. He mixed cornstarch and water, creating a white gruel. "When I wham this, it'll be rigid," he said confidently. But when he smashed his fist into the basin, the mixture splashed all over the lecture table, the floor and his face (opposite). "What happened?" he stammered, throwing up his hands in a deftly executed MTM. Looking daunted, he added more cornstarch, again plunging his fist into the mixture. This time the fluid instantly turned as stiff as wet sand, not a drop flying from the bowl. The professor, his face dripping cornstarch, looked blankly at the applauding students.

To help explain complicated ideas, Walker likes to use simple props with which his students are familiar. He demonstrates conservation of angular momentum by sitting on a swivel chair and holding a bicycle wheel straight up and down. When he spins the wheel in the vertical position, nothing happens visibly because the chair does not swivel vertically. But when he turns the spinning wheel over on its side, Walker begins to rotate in the opposite direction on his chair, a human expression of this and another immutable law of physics: for every action there is an equal and opposite reaction (p. 115).

The creative engine behind all of Walker's stunts is his voracious appetite for physics. He reads more than 100 scientific journals, stuffing copies of articles that particularly interest him into his bulging file drawers. He turns cooking and other routine household chores into ongoing experiments. (Once, fascinated with the "physics" of meringue, he ended up strewing batches of the stuff all over his kitchen. "To this day, I can't stand the sight of it," he says.) He even turns hobbies into physics lessons. He likes, for example, to play racquetball, which he sees as an interplay of the forces driving the Universe: friction and spin, speed and mass, momentum, gravitation and all the subtleties of collision, bounce and trajectory. He has computed the forces at work in the virtually unhittable "Z shot," in which the ball bounces from the front wall to the side wall and then slithers down the back wall to the floor —and has found out how to execute the shot. Once he tried using a Superball, which loses little energy in collision, and produced a nightmare. "It wouldn't stop bouncing!" he exclaims.

Walker's antics may strike some pedagogues as a clear case of pandering to the modern student's desire for instant entertainment. But at a time when the nation is once again reassessing its educational ends and means, his commitment and creativity may suggest to others a new standard in professionalism and new possibilities for enlivening curricula in the humanities as well as the sciences. Be that as it may, this much is certain at CSU: Walker's students appreciate what he is doing. "He's getting his point across and I'm learning," says Rose Duke, a computer-science major from Wickliffe, Ohio.

Walker's own favorite evidence of his success is, as you might expect, eccentric. Not long ago, an acquaintance showed him some graffiti on the men's-room wall of a bar in one of Cleveland's rougher sections. Someone had written, "Who knows where the red of the rainbow ends and the yellow begins?" Underneath, someone else had penciled in, "Just ask Jearl Walker."

In "failed" demonstration, Walker smashes fist into cornstarch mixture, making a splash class can't forget.

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GMC TRUCK

IT'S NOT JUST A TRUCK ANYMORE.

By J. Tevere MacFadyen

Educated monkeys help the disabled to help themselves

Once it was regarded with skepticism, but today a program that trains simian aides for quadriplegics is considered a solid success

Gary Finkle's monkey, Jo, sits on laser device used to point out such tasks as fetching food or magazines.

Try this: take the most comfortable chair you own into the pleasantest room in your house, arrange it in a convenient location and sit down. Don't move. Wait 15 or 20 minutes for your muscles to loosen up. Relax. Look around; take stock of your surroundings. If any visitors walk in, you can turn your head to greet them but you can't stand or shake hands. You can admire the view out your window, but you can't crack it open for a breath of fresh air if the room becomes stuffy or warm. Wait another hour. Are you bored yet? Hungry? Thirsty? Sorry, but you'll just have to wait until somebody happens by. Don't worry, it shouldn't be too long —probably no more than a couple of hours.

Welcome to the world of the quadriplegic, Gary Finkle's world ever since he was injured in a swimming-pool accident seven years ago. Gary is one of an estimated 90,000 Americans who have lost virtually all feeling and movement below their shoulders due to severe spinal-cord injuries. He lives with his wife, Micki, and a female capuchin monkey named Jo in a new home on a hilltop outside the village of Andes, New York, about three hours north of New York City. When I visited him there recently, Jo was perched protectively on the back of his wheelchair.

Gary Finkle is a charter participant in a remarkable enterprise called Helping Hands: Simian Aides for the Disabled. The nonprofit organization supplies quadriplegics with trained capuchins that increase their self-reliance and reduce their dependency on friends and family or hired attendants. Shortly after it started up eight years ago, Helping Hands received a spate of publicity in newspapers, magazines and on television. By now it has long since progressed from the novelty stage to become a proven success that makes a real difference in the lives of the people it serves.

Just look at Gary and Jo. Gary uses his mouth to control a small laser-pointer mounted on his wheelchair. With it, he directs Jo to open and shut doors, turn lights on or off, change books or magazines in a reading stand or audiotapes in a cassette player. She brings him prepared snacks and drinks from the refrigerator and clears away empties. She will even feed him. On command, Jo fetches the remote control for Gary's TV, placing it on the chair where he can manipulate it with his mouthstick. The mouthstick is a quadriplegic's primary tool. It is used for practically everything: turning the pages of a book, dialing the telephone, changing channels on the TV, working at a typewriter or computer. If Gary's mouthstick drops to the floor, Jo will retrieve it and gently reinsert it into his mouth. "I definitely cannot imagine living without her," he says.

Jo has been with the Finkles for more than three years. She has become so fully integrated into their lives that, in describing her, they tend to talk not

Quartet of capuchins clings to trainer Alison Pascoe at Albert Einstein Medical College in New York City.

Photographs by Jose Azel

Mary Joan Willard, director of Helping Hands, works with monkey as Alison Pascoe videotapes session.

about what she does but about who she is, her personality and style. "She's smarter than we give her credit for," Gary ventures fondly. "Sometimes she's too smart," adds Micki, who once located a missing tube of lipstick hidden in Jo's cage: she'd apparently found the stuff quite tasty.

"The main thing is independence," Gary reflects. He knows that he will always need human assistance for such things as getting in and out of bed, bathing or changing his clothes. But having Jo measurably lessens his reliance on Micki, enabling her to work afternoons in town without worrying about her husband's welfare. Above and beyond Jo's obvious utility, Gary prizes her companionship. "She's a constant source of entertainment," he marvels, "and she just keeps getting smarter. The more she's exposed to, the more she learns. I want to teach her to play backgammon."

Heavyset and bearded, with a mane of curly black hair, Gary came to Helping Hands by way of New York's Rusk Institute, a renowned rehabilitation center. "It seemed like a great challenge," he recalls. "I've been around animals all my life and I guess I just thought this would be fun." Nowadays Jo goes almost everywhere with him, indoors and out, on social calls or forays to the local tavern. Wherever they go they draw attention. "I've certainly met people I wouldn't have met without her," Gary says. When I ask if a robot might not one day be able to do many of the jobs Jo does for him now, Gary answers, "Robots won't play with you. They won't jump around your living room or wrestle with the dogs. They won't comb your hair and beard with their hands or sit on the laser, chewing at your face. A robot would be pretty dull."

On the sixth floor of Abraham Mazer Hall at the Albert Einstein College of Medicine in New York, the corridor resounds with shrieking chirrups and trills. Ringing bells punctuate a hubbub of hollers and howls, weird catcalls and cries, crashes, claps and bangs. The cinder-block walls are dull institutional yellow; the floor is faded linoleum. What little furniture there is appears to have taken quite a beating. Windows are missing from the doors to several offices and have been replaced with wire mesh. If the place looks a bit disheveled, there is good reason. Here, in cubicles where medical students once crammed for exams, "organ-grinder monkeys" are learning to help the handicapped. "We're very lucky to be here," Dr. Mary Joan Willard tells me as we step from the elevator to be greeted by a chattering capuchin chorus. An assistant professor of rehabilitation medicine at Einstein, Willard—who is called M. J. by just about everyone—is the founder and director of Helping Hands. "People kill for space at this institution," she explains. "If we weren't here, we'd probably be down in the basement or someplace awful."

In 1977, Willard was a postdoctoral fellow in psychology at Tufts New England Medical Center in Boston. There she befriended a 23-year-old quadriplegic who was paralyzed from the neck down. Visiting him, she confronted the central fact of paralysis: utter dependence. There was practically nothing he could do without help. "As a psychologist," she says, "I was obsessed with the notion that there had to be some way to increase his independence."

Willard had spent three years as a research assistant to B. F. Skinner, the eminent psychologist at Harvard University whose research pioneered the still controversial theories of behavior modification. It occurred to her that Skinner's reward-and-punishment techniques might be used to train primates to assist the disabled. "I was literally lying in bed one night when it hit me," she remembers. "Why not use chimps?" Chimpanzees, it emerged, had some practical drawbacks: they grow to be nearly as big as people and a good deal stronger, and adult chimps are prone to fractiousness. But Skinner thought the scheme had merit and suggested capuchins instead. Mature capuchins weigh roughly five pounds and stand less than 18 inches tall. They respond well to training and form loyal bonds with humans. After a preliminary investigation, Willard resolved to proceed. Armed with a small grant from Tufts Medical School, she purchased a quartet of laboratory-bred *Cebus albifrons*, and Helping Hands was on its way.

J. Tevere MacFadyen has written most recently for SMITHSONIAN *about the transportation of hazardous materials and Houston's ship channel.*

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PURE VIRGIN WOOL

After removing drink from refrigerator, Jo takes off cap and inserts a tube for Gary Finkle to use as a straw.

The godmother of simian aides, M. J. Willard is a slim, small brunette who looks a decade younger than her 36 years. Her manner is direct and informal. When she convenes a lunchtime meeting in her office, everyone sits on the floor. Present are Alison Pascoe, Lauren Westbrook and Alice Levee, the three young women who form the core of the training staff at Einstein. Other key staffers are not based in New York. David Taylor, a high school science teacher from Byfield, Massachusetts, coordinates the "foster family" network which places infant capuchins in human homes before they're ready for training. Judi Zazula, a biomedical engineer in Boston, oversees the actual placement of monkeys and screens disabled applicants to check their suitability for inclusion in the program. Her partner, Doug Ely, a physicist with Arthur D. Little Inc., designs and constructs much of the specialized equipment the project requires.

On the agenda this noon are a review of current training and an evaluation of the volunteer trainers, 14 in all, most of them undergraduates at nearby Fordham University. Alison's pet capuchin, Amelia, nestles in my lap. "You'd never know how mean she was, would you?" Alison chuckles as Amelia attempts to relieve me of my pen. Amelia is a *Cebus apella*, a species of the genus *Cebus* that is considered more tractable and relaxed than the perpetually antic *albifrons*. The first monkey permanently placed with a quadriplegic was an *albifrons*, but the seven placed since have been calmer *apella/albifrons* hybrids. All but one of the simian aides thus far have been females, who are less aggressive, have fewer bad habits and seem to form stronger bonds than males.

Until recently, most of the animals obtained by the program have been adults with checkered pasts. Some are cast-off pets or zoo monkeys, others veterans of laboratory experimentation. A capuchin named Freeway was found loping alongside an interstate. As Helping Hands has gained visibility it has become known as a safe haven for refugee monkeys, but Alison notes some problems in working with animals from unknown backgrounds. "We never have any idea how they've been treated," she says. Cleo, for instance, a candidate for placement with a young cerebral-palsy victim, arrived at Einstein introverted and malnourished. As Alice Levee observes, "It's hard to expect food-motivated behavior from an anorexic animal."

While older animals will still be accepted, young monkeys, many of them born at the Mannheimer Primatological Foundation in Florida where Helping Hands has established a breeding colony, will constitute the majority in the future. Four of the six animals now at Einstein were raised specifically for Helping Hands, and another 25 or so are currently living with foster families. Foster care commences immediately after weaning, at six to eight weeks. Three years later, when the monkeys reach maturity, their teeth are extracted to guard against the chance that they might wound someone with a bite. Then they are ready for

Trainer at Einstein watches monkey put magnet on the page of a magazine it previously placed on a rack.

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six months or so of training. The animals are trained as early as possible in order to prolong their useful life after placement. They live for about 30 years.

Down the hall in a battered training room a monkey named Marylin is burning off some excess energy. She vaults from table to chair to wardrobe to windowsill to chair, flicking the lights on and off, repeatedly testing the knob of the firmly locked door, yowling and cheeping and making faces. "She'll settle down," Alison promises, and soon enough she does. I sit immobile in a wheelchair, playing the role of a quadriplegic, as Alison puts the capuchin through her paces. After spending several months with a 54-year-old quadriplegic man in New Jersey, Marylin has returned to Einstein for a refresher course. "Change, Marylin," Alison instructs. "Change."

Marylin enjoys her sticky treat

With a laser-pointer the trainer indicates a magazine in a plastic binder on a shelf, which Marylin, after a brief hesitation, crosses the room to collect. She carries it to a nearby reading stand, removes the binder already on the stand and puts the new one in its place, clapping a steel washer attached to the binder onto a round magnet atop the reading stand. Alison rings a bell, signifying success, and Marylin scoots over to my chair for her reward—a sip of sticky, strawberry-flavored Nutrament—which I dispense by blowing into a plastic tube mounted beside my headrest. The tube descends into a bottle fixed to the chair's frame. Blowing into it forces a thimbleful of liquid into a cup in the bottle's cap, which Marylin greedily licks clean.

Whenever a monkey properly executes an assignment it receives a reward. If the task is not completed, or is done incorrectly, the reward is denied. An astonishing range of behaviors can be instilled using this system. The monkeys learn to respond to verbal commands like "Fetch" or "Change," as well as visual cues from the laser-pointer. Complex activities, such as bringing food and feeding, are subdivided into discrete tasks so that the animal's abilities expand as the components of a procedure are linked.

Trainers may bestow rewards in the form of a bit of peanut butter dabbed onto a finger, but quadriplegics use mouth-activated dispensers, either the liquid type or a sort of carousel loaded with pelletized chow. Negative reinforcement is administered by way of a tiny battery-powered backpack which can deliver a slight electric shock—Alison compares it to the static charge sometimes generated by touching a metal doorknob—should the monkey misbehave. Capuchins are endlessly curious and their natural inquisitiveness is what often gets them into trouble.

Willard remembers one early placement that had a tendency to "tear up the house" when she wasn't working. The solution to that was the shock-pack, used in conjunction with little white circular stickers called coding dots. The animal quickly learned to associate the dots with an imminent shock and henceforth avoided touching anything with a sticker affixed to it. In practice, quadriplegics seldom shock their monkeys and some abandon the shock-pack altogether.

Sue Strong's helper, Henri, waits for reward after putting a sandwich in holder and opening container.

Capuchins sleep in large wire-mesh cages that are prominent features of their owners' households. Unlike most children, the monkeys will go to their "rooms" on command and obediently close the door behind them. They are housebroken, having been taught to eliminate only in their cages, but they occasionally make mistakes. Capuchins tend to be fastidious. "In general, they're very clean," Alison reports. "Some of them don't even like to eat bananas because they don't want to get their hands dirty. You have to wrap the fruit in napkins."

The animals are formidably bright. They can master new tasks in a single half-hour training session and once a procedure is learned, their performance reliability is close to 100 percent. When researchers were

If Strong doesn't quickly dispense treat by blowing into tube near face, Henri will push her chin toward it.

working on a new "toilet-training" technique, they devised a sort of stovepipe contraption with an electric eye in its base. After a monkey defecated into the pipe, the feces dropped through the optical beam and triggered dispensation of a sweet reward. One day the trainer left a capuchin alone with the device for 15 minutes and returned to discover that the electric eye had been tripped dozens of times. The animal had discovered that by dangling a strip of its bedding down the pipe it could gain an endless supply of rewards.

More than once in its formative years, Helping Hands came close to shutting down. Even after the initial experiments proved promising, 38 potential sponsors refused Willard's requests for financial help. When she turned to the Veterans Administration, an official there told her, "Look, this is a fantastic idea and if it works, great. But if it doesn't work you're going to get the Golden Fleece award, and we don't want to be funding you when you get it." The agency eventually went on to become the project's principal backer, but it was the Paralyzed Veterans of America that really got things going by awarding Willard her first major grant, late in 1979.

Sometimes pure good fortune seems to have intervened. The American Society of Rehabilitative Medicine rejected Willard's scientific paper on simian aides, but then mistakenly printed the abstract in its proceedings anyway. A flood of inquiries resulted. Willard developed a knack for public relations. "I've always known this project was borderline crazy in terms of people's perceptions of it," she says, "so I've learned to capitalize on its sexiness. I feel a little guilty about that but it works."

Though she admits to some frustration over the constant grind of fund raising, Willard finds some solace in history. After all, she points out, training guide dogs to lead the blind did not begin in earnest until a century after the idea was first proposed in 1819. Even today, only five percent of all blind persons use Seeing Eye dogs. "We expect to be placing ten to 20 animals a year soon, and expanding from there," she predicts.

Requests for helpers exceed supply

On the sixth floor of Mazer Hall, using mostly begged and borrowed equipment, the Helping Hands staff has just finished videotaping the entire training process. Along with a 108-page instructional manual, these tapes should go a long way toward helping others replicate Helping Hands' success. Already, rehabilitation centers in Canada, Argentina and Israel have initiated simian-aide programs of their own. In this country, requests for capuchin aides far outstrip the available supply. Willard has received more than 600 inquiries from quadriplegics or their families.

Some rehabilitation specialists argue that simian aides will be appropriate for only a fraction of the nation's disabled, and that research money might be better directed to other areas such as robotics. Willard disagrees. "We're training the animals to do some things that will be very difficult for robots to accomplish," she says. "Monkeys aren't for everyone, but dollar for dollar I can't think of anything that will have a greater positive impact on a quadriplegic's life." Monkeys are "all over their owners," says Alison Pascoe, "kissing and touching and exploring, and I think that's terribly meaningful."

Judi Zazula, who's been associated with Helping Hands almost from its inception, conducts an exhaustive evaluation of every applicant to the program. "Not all quadriplegics are super people," she says. "A lazy person before an accident will likely be a lazy paralyzed person." Zazula looks for people who are interested and energetic, and who have the kinds of particular needs that monkeys can help meet.

Quadriplegics need special equipment in order to work well with their monkeys. The feeding tray, for instance, is an apparatus fitted with attachments and

receptacles exactly matched to the drink bottles and food holders a quadriplegic will use. Now made of nearly indestructible molded plastic, earlier models were fashioned from Plexiglas, cardboard and duct tape. "We use off-the-shelf components whenever we can," Doug Ely tells me, "but some things have to be specially made." The socket into which a sandwich holder fits looks vaguely familiar. As well it might, Ely confirms. It's a modified vacuum-cleaner crevice tool.

Given her professional expertise, Judi Zazula might be expected to focus on Helping Hands' more pragmatic aspects: the ways in which capuchins can help disabled people accomplish basic tasks. But like everyone else I spoke with, she seems most profoundly affected by the monkeys' impact on the quality of the quadriplegics' lives. As part of the research for her master's thesis she watched people react to a quadriplegic in a shopping center. When he was alone, only two strangers approached the young man to talk in the course of an hour. When he was accompanied by his capuchin, 71 passersby paused to chat. Says Zazula, "Giving a quadriplegic a monkey makes him an 'expert' on something that fascinates able-bodied people." Sue Strong puts it this way: "When I go outdoors in my wheelchair, all that people see is the wheelchair. But when I go out with my monkey, the only thing they see is the monkey. Nobody notices the chair at all."

Sue Strong is an attractive 35-year-old woman with an engaging grin, swept-back chestnut hair and partial movement in her upper right arm. Fifteen years ago she was on her way West for a summer of fun when the steering wheel of the van in which she was riding separated from the steering column. The vehicle crashed and rolled, and Sue Strong awoke to the world of quadriplegia. She lives in a rent-controlled apartment on Manhattan's East Side. Her quarters are airy and light, eclectically decorated, hung with posters and art. Part-time attendants see to most of Sue's daily needs; her only full-time companion is a female capuchin named Henri, short for Henrietta. "Having her has completely changed my life," Sue says. "Before, I had to depend on people coming in to work, and worry about whether or not they'd show up on time. Now, if I'm up in my chair and feeling OK, Henri and I can get along fine on our own."

When Strong drops her mouthstick, she quietly says "Mouth, Henri. Mouth!" The capuchin searches until she locates the lost tool, then hops deftly up and returns it to Sue's mouth. "We've had to learn how each other thinks," says Sue. "I have to be careful not to expect too much. I forget that she can't read my mind."

Henri is dispatched to the kitchen for a sandwich. She returns with the food and positions it in the holder on the feeding tray so that Sue can eat, but she can't quite resist trying a small bite for herself. Instantly, she realizes she's screwed up, and almost before her owner gives the command she rushes yowling into her cage. "Door, Henri!" Sue intones with mock sternness. Henri yanks the door closed, then peers anxiously out, awaiting a reprieve. It is not long in coming.

"Oh, all right," Sue concedes, laughing as she guides her chair over to liberate the keening capuchin. Freed, Henri directly curls up on her mistress' ankles, craning her neck to gaze up at Sue, the very picture of contrition. Sue laughs out loud. "Look at that, will you!" she says. "A face only a mother could love."

Henri gives her mistress' finger a squeeze. Such touching moments endear monkeys to their owners.

At Einstein training facility, Alison Pascoe teaches future "helping hand" to get objects indicated by laser.

By Alfred Meyer

Daily rise and fall of the nation's revered documents

The very latest in space-age high science is being employed at the National Archives to protect America's Charters of Freedom

Promptly every night at the National Archives Building in Washington, D.C., the Charters of Freedom are put to bed. Hermetically sealed in individual helium-filled bronze-and-glass containers, the Declaration of Independence, pages of the Constitution, and the Bill of Rights are lowered by mechanical scissorjacks from their bulletproof display case into a vault 22 feet directly below. Built of steel and reinforced concrete, the 55-ton vault was thought to be atom-bomb proof when it was installed in the early 1950s, the heyday of bomb shelters and a time of more modest megatonnage. Even so, the vault is largely impregnable.

Then, in the morning as visitors begin queuing up outside, a sort of rumbling sound occurs, the vault's interleaved ceiling swings open like the lid of an iron-sided jack-in-the-box, and the documents are once again elevated into the muted light of the Exhibition Hall, to be gazed upon throughout the day.

While the vault and its well-oiled inner and outer workings suggest the stolidity and industrial brawn of a 19th-century locomotive—and rumble just about as much—the atmosphere in the hall above us is distinctly High Church—buffed marble, shuffling feet, the occasional cough or whisper. Except, that is, for the armed guard standing near the display altar. Or the hidden devices by which, at a moment's notice, the documents can be pulled down into the safety of the vault. Like the rest of official Washington, the Archives is keenly terrorist conscious.

But beginning sometime this month—just about a year away from the Constitution's 200th birthday, September 1987—an ultrasophisticated piece of space technology will be enlisted to help safeguard the documents in a different way. The technology has nothing to do with fortification or security in the ordinary sense. Rather it has to do with light and vision, particularly with photons, the electromagnetic units by which light energy is transmitted.

Developed initially to record the faint wisps of starlight gathered by telescopes aboard orbiting satellites, the heart of the new technology is a sensor in an electronic, computer-assisted camera. The sensor is known as a Charge-Coupled Device (CCD). It will be blindly incurious about the meaning of July 4, 1776, or the political significance of the words "We the people," or the nature of the articles that define America's cherished civil liberties.

Instead, when functional it will once a year look through the two permanent layers of containment glass and focus on topography—strokes of ink and wrinkles of parchment. In doing so, it will see with powers of discrimination far in excess of either the human eye or ordinary film cameras. More important, the computer, which works in conjunction with the camera, will remember what it sees with an exactitude that is not only beyond the limits of human visual recall and conventional before-and-after photography, but is rare enough even in scientific laboratories where it is often difficult to faithfully reproduce the conditions of an original experiment, especially where light is critically involved.

High-tech hunt for any changes

The mission of the new camera is deceptively simple: to establish a series of images taken over time and under precisely identical conditions so that sequential images can be compared with one another. The point is to be able to detect any visible change in the character of either ink or parchment. In the event of change, remedial action by archivists and conservators might well be indicated.

The difficulty lies in reproducing, time after time, the same conditions of light and temperature. To achieve this, the camera will be housed in what amounts to a closed system, providing its own light and cooling sources, both exquisitely measured and controlled by the system's own computer. On each occasion, therefore, an identical stream of photons will travel through the same temperatures at the same

Kenneth E. Harris, conservation chief, buffs glass in vault room, 22 feet below floor of exhibition hall.

Photographs by Stephen Brown

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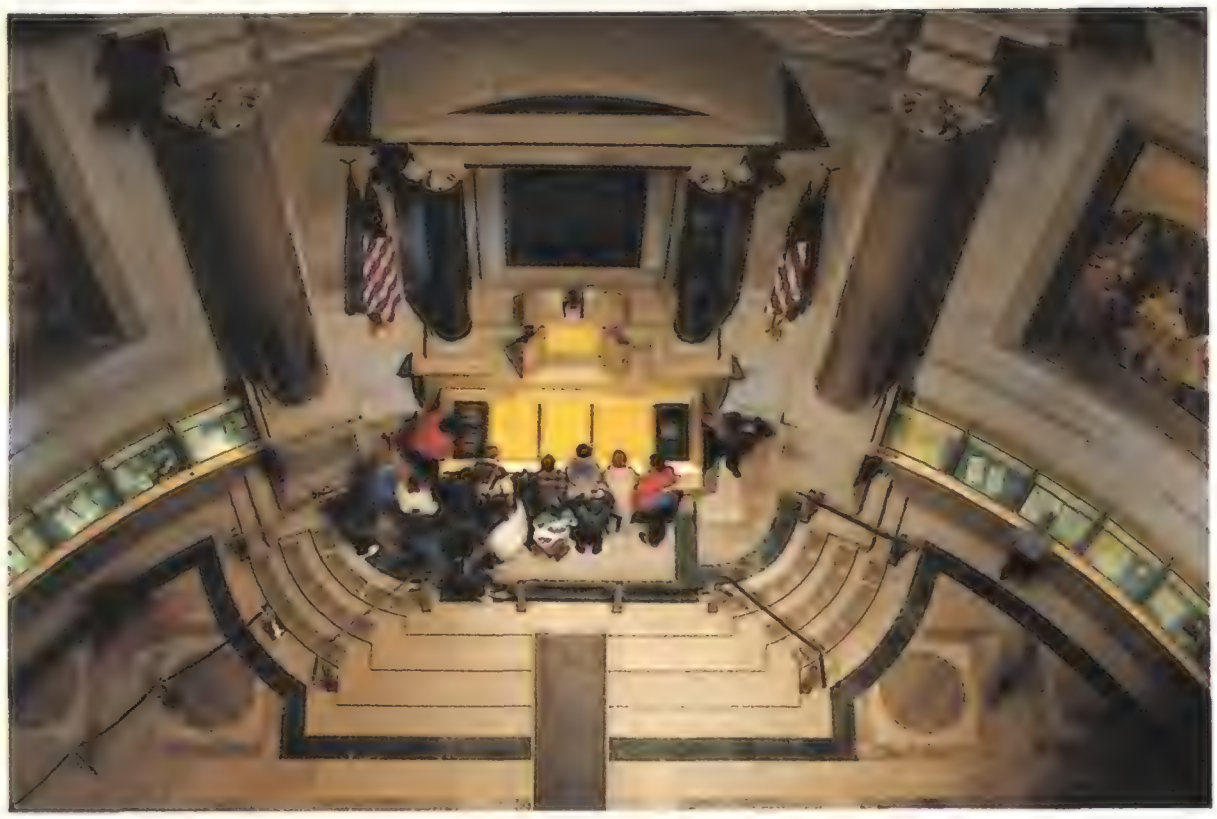

View from an aperture in apex of the National Archives rotunda shows visitors gazing at the documents that define America.

speed, strike the ink and parchment at the same angle, and finally reflect onto the camera's electronic sensor, actually a solid-state silicon chip with a line of 1,024 light-sensitive areas, or pixels, which scans precisely 1,024 consecutive rows, in all adding up to a picture only one square inch in size. From the sensor, the image made by these photon impacts is simultaneously fed into the computer, which immediately digitizes it, making it ready for either storage or display. The computer can also now begin the job of detecting change from the previous images stored in its prodigious and exacting memory.

Unfortunately, despite extraordinary care in recent years and the potential of this new monitoring system to provide early warning, the Charters face a downhill battle. History and time have not been particularly kind to them, especially not to the Declaration.

The documents themselves were known to be in different states of deterioration when, in 1952, they were first placed in the glass containers that still hold them today. Preservation technology at the time dictated that the atmosphere within the cases be filled with helium and water vapor—helium to replace oxygen and prevent oxidation, water vapor to keep the enclosed air adequately humidified. Too little moisture would dehydrate protein molecules and cause the parchment to crack. Thus far the helium environment has proved effective, at least judging from visual inspection and regular checking of the cases with air-leak detectors. However, helium leaks out through glass whereas air does not, so at some point the helium may need to be replenished.

Since the Constitution and the Bill of Rights came into existence 11 and 13 years, respectively, after the Declaration, and to a great extent have played second and third fiddles to it ever since, they are in relatively good shape. As it happens, the Constitution was rather less frequently handled than its companion documents. Before 1952, on the other hand, the Declaration led what seems a life that involved a lot of wear and tear.

Washingtonian Alfred Meyer wrote about Hundertwasser's house in the January issue of SMITHSONIAN.

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Although the Continental Congress officially adopted the Declaration on July 4, 1776, it was not until August 2 that the engrossed version on parchment was formally ready for signature in Philadelphia. The process of deterioration undoubtedly began almost as soon as the ink was dry, if not before. Since parchment is stretched animal skin, it is vulnerable to mold even after its initial preparation in a lime solution. Nor was it immune to the bleaching of sunlight or to the nibbles of insects and rodents. Furthermore, the material does not absorb ink like paper, and if the surface is not properly prepared, the wet ink instead sits on the skin. When dry, the ink is not well-adhered and has a tendency to flake off, particularly in the event of handling, of which the Declaration received more than its fair share, not least from the way it was initially stored—rolled up from top to bottom. Such a procedure meant that the signature portion of the document lay just inside the outer ring and was therefore more exposed and abraded as all 56 signatures were affixed. Add the fact that some signers wrote more delicately than others, then it comes as no surprise that the signature portion was the first to begin to fade into illegibility.

Meanwhile, however, a serious revolution was at hand and the government of the self-declared new nation was frequently on the move, hauling its precious instrument with it as it sought to keep a step or two ahead of the British. By the time the Constitution was signed on September 17, 1787, in Philadelphia, the Declaration had journeyed to Baltimore, back to Philadelphia, on to Lancaster and York, Pennsylvania, back to Philadelphia, up to Princeton, down to Annapolis, up to Trenton, and then even farther up to New York City. There it remained at City Hall until 1790, when it came back to Philadelphia, now in the company of the recently signed Constitution. Afterward, all three were at last sailed down to the new federal capital in the District of Columbia in 1800; sailed

National Archives

Documents arrive for safekeeping at the Constitution Avenue entrance of the Archives on December 13, 1952.

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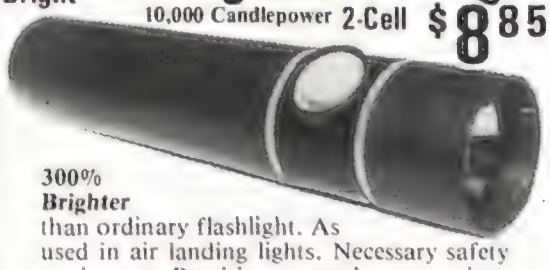

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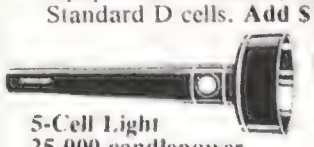

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Young viewer, one of 1,078,530 people who visited the Archives last year, surveys the Declaration of Independence.

because they made the trip by boat: down the Delaware River and Bay, out into the Atlantic, into the Chesapeake Bay, and finally up the Potomac to Washington. By then, clearly, the Declaration had already been through the mill.

Except for two occasions, the documents stayed in Washington until the onset of World War II. In the summer of 1814 during the British attack on Washington they were removed to Leesburg, Virginia, and in 1876 the Declaration traveled to Philadelphia for the nation's Centennial celebration. Nevertheless, the long tenure in the capital was far from sedentary. The Declaration, for example, was shunted to no fewer than 17 different locations before it was settled in at the Library of Congress in 1921. Then, following the Japanese attack on Pearl Harbor, the three documents were once again packed up, this time bound for safekeeping in the Bullion Depository at Fort Knox, Kentucky. Although the Declaration was briefly brought to Washington in 1943 for the dedication of the Jefferson Memorial, the documents stayed at Fort Knox until 1944 when they were returned to the custody of the Library.

While it would be incorrect to infer that the documents were at times treated with gross neglect, it would be nearer the truth to claim that they suffered from benign neglect—and inadvertence and ignorance. Beginning in the last decade of the 19th century, Congress started taking the question of deterioration seriously and appointed a series of committees, usually organized by the Academy of Sciences, to evaluate the physical condition of the Declaration and recommend improved methods of preservation and display. Yet, as Alan Calmes, currently preservation officer for the National Archives, has pointed out, "preservation and display are potentially contradictory." Indeed, beyond the jostling of transit, the two occasions on which the Declaration was most markedly damaged resulted, first, from an effort to disseminate its contents more widely through a printing process and, second, from a misguided display setting.

In 1823, William J. Stone, a Washington engraver, completed a facsimile of the Declaration by using a method of copperplate engraving. It

is thought that this process may have required a "wet sheet transfer" from the original, resulting in some of the slightly soluble surface ink being removed. Then, in 1841, the Declaration was placed on exhibit for 35 years in the Patent Office Building—hung vertically between two panes of glass. The trouble was that it was put in a white-painted hall and hung directly opposite a window, leaving it virtually naked to the damaging ultraviolet content of sunlight. Indeed, by the time it was displayed at the Centennial in Philadelphia, the Declaration had become a mere shadow of its former self, dim with age, many of the signatures now completely illegible.

Perhaps the most poignant description of its sorry state was written in 1942 by George L. Stout, a Fogg Museum of Art official who examined it at Fort Knox. He found that it had become partially detached from its mount, particularly at its upper right-hand corner, which someone had clumsily attempted to plaster down with vast amounts of glue. "At one time also (about January 12, 1940)," he wrote, "an attempt had been made to reunite the detached upper right-hand corner to the main portion by means of a strip of 'Scotch' cellulose tape which was still in place, discolored to a molasses color."

Not long after, the Scotch tape was removed and the rent and other cracks were carefully repaired. In a way, this work was a signal that the document was about to undergo something of a resurrection, not only through preservation efforts but also in the display prominence to which it and its companions were shortly to return.

Back at the Library of Congress after the war, and following lengthy deliberation by scientists from the National Bureau of Standards, the Charters were sealed into the helium-filled encasements in which they have resided ever since. Then, in 1952, with great ceremony and under heavy guard, they were transferred to the National Archives Building where the

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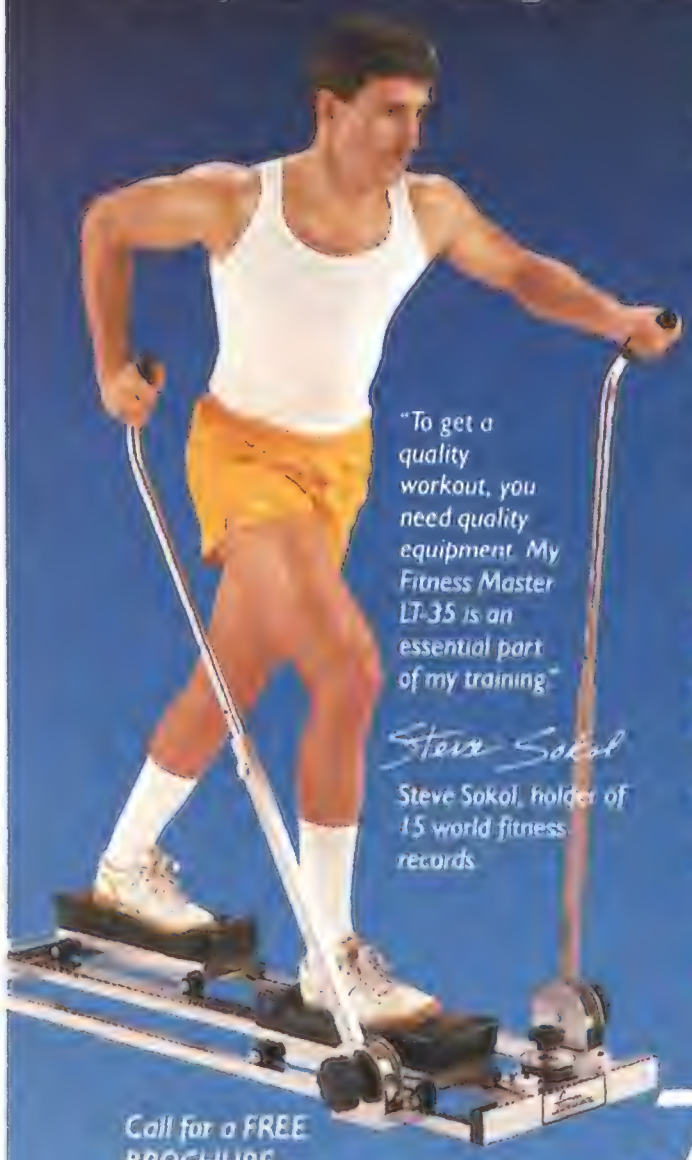

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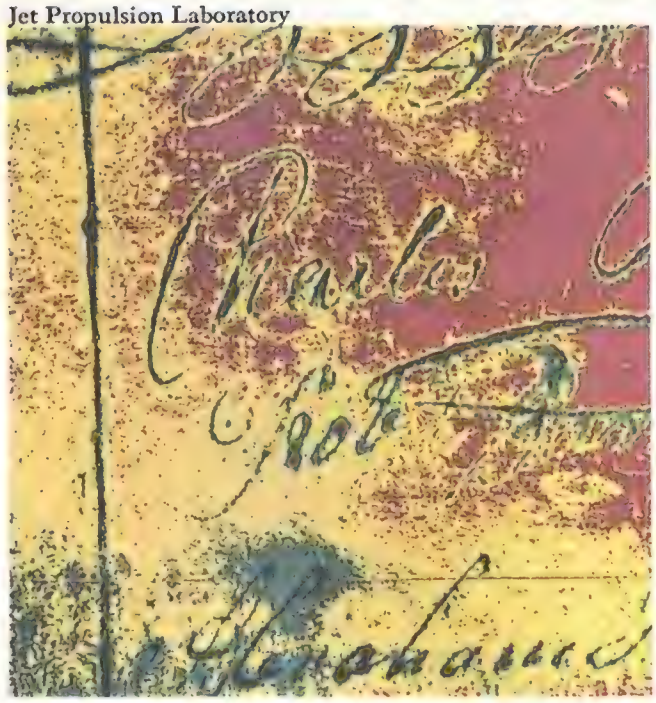

Computer-camera-produced image of test documents aids in preservation.

vault and the appropriately illuminated Exhibition Hall awaited them.

Despite the obvious care lavished on the Charters in recent years, however, concern over their well-being surfaced once more in Congress and elsewhere. Specific worries centered on a scratch in the glass covering the third page of the Constitution, the diffusion of helium through the containment glass, the annual handling of documents for display purposes on Constitution Day, and the daily movement from the vault to the display altar and back. Accordingly, the Archives assembled a blue-ribbon committee of scientists and conservators in 1982 to inspect the Charters.

They determined that the scratch was inconsequential. The Jet Propulsion Laboratory, a NASA field installation, added that at some unpredictable time, when the helium diffuses, the encasements would need to be opened, refilled with protective gas and resealed. The special committee determined as well that both annual handling and the daily jacking should be improved, the latter possibly by converting to a hydraulic lift system. Since the encasement glass touches the documents, the slight vibrations during movement could exacerbate ink flaking. As far as they

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could tell, however, no serious deterioration had taken place since the documents were encased.

But therein lay a problem. The committee couldn't be altogether certain, despite being able to look at the documents and comparing past and present photographs taken with ordinary light cameras. Insufficient data, they concluded, prevented their evaluation from being comprehensive. What was needed was a reliable scientifically advanced monitoring system.

At this stage the then Archivist of the United States, Robert M. Warner, called upon NASA, which in turn contacted the Jet Propulsion Laboratory. Part of the California Institute of Technology in Pasadena, the Lab at the time was hard at work putting the finishing touches on an infrared astronomy satellite that was scheduled for launch in 1983. At an earlier design phase was an even more ambitious satellite, known as the Hubble Space Telescope. Once aloft, its eight-foot-diameter optical mirror riding high above the thick moist filter of the Earth's atmosphere will be able to see entities at least 12 billion light-years distant. That is approximately 85 percent of the way to the edges of the Universe, a breathtaking prospect.

But key to the technology employed in many modern space observation systems is a relatively new kind of electronic camera, the Charge-Coupled Device camera. Couldn't it be used in some way to monitor the Charters? The Jet Propulsion Lab thought that it could and, under contract to the National Archives, proceeded to bring to Pasadena for tests both a sample containment case and a document with properties similar to those of the Charters (p.142).

The tests proved successful and beginning any minute, according to the schedule, the Charge-Coupled Device camera will annually peer at the Charters and record their condition. Its tandem computer will not only be able to detect ink fading and flaking, but also the most minute change in the documents themselves, whether brought about by illumination, temperature fluctuations, helium loss or the daily migration from the vault.

Surely there must be at the Archives these days some deep sense of satisfaction with the almost cosmic link that is about to be established, if only generically, between an orbiting telescope and camera whose sights are directed toward the limits of the Universe and a cousin camera at home set to keep careful watch over some extraordinary pages of parchment.

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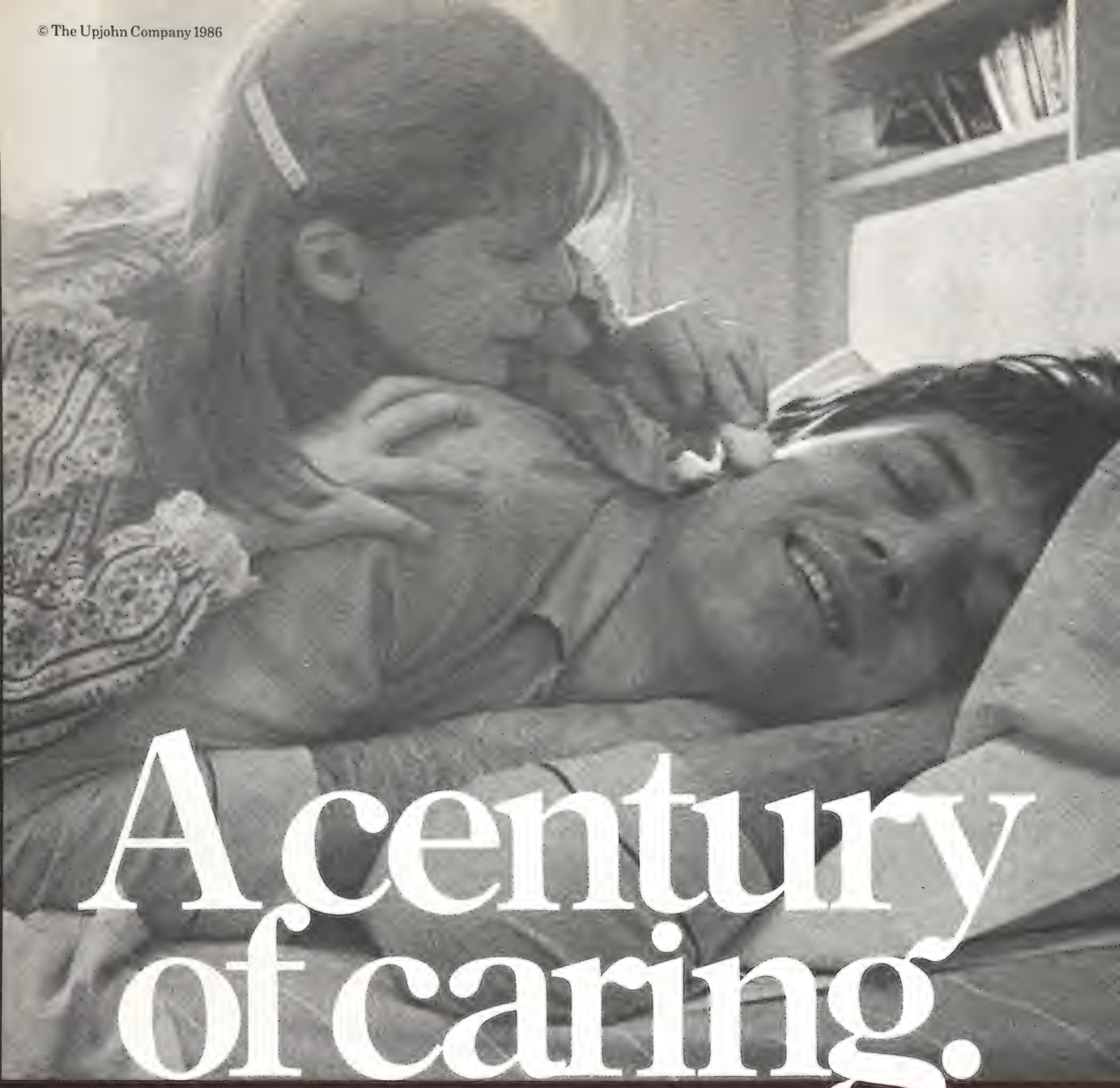

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By Pico Iyer

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sia, then also in Syria, ready to follow to the grave—and beyond—such charismatic leaders as Hasan-i Sabbah and Sinan ibn Salman ibn Muhammad (known as the "Old Man of the Mountain"), the Assassins discovered that, with a single carefully planned blow, a tiny force prepared to die in the course of killing others could cripple a Goliath of an enemy. They realized, too, that the fear or memory of such an attack could be as paralyzing as an attack itself. From A.D. 1090 to about 1256 the Assassins used those precepts to unsettle everyone who opposed them—killing viziers and kings, attacking the great Muslim hero Saladin, and eventually doing battle with the forces first brought by Genghis Khan during the Mongol

Hasan-i Sabbah, a charismatic Shiite scholar, was the arch-Assassin; all his portraits are of dubious accuracy.

invasion of the Middle East. It was even said that they served as hired killers for the Crusader King, Richard the Lion Hearted of England.

For 800 years, the sect has been largely shrouded in mystery and still is glimpsed through a mist of rumors and charges and speculations. But it is known that the word assassin, still used to describe a political murderer, was applied to members of the sect, and that the name itself seems to have originated in the Arabic word *hashishiyyin*, which is the colloquial plural of *hashish*.

The intriguing connection between the two, like the whole mysterious legend of the Assassins, was most fancifully presented by Marco Polo, who passed through Persia in 1273. Speaking of the Assassin chief, Polo wrote: "He had caused a certain valley between two mountains to be enclosed, and had turned it into a garden, the largest and most beautiful that ever was seen . . . flowing freely with wine and milk and honey and water; and numbers of ladies and of the most beautiful damsels in the world, who could play on all manner of instruments and sung most sweetly, and danced in a manner that it was charming to behold. For the Old Man desired to make his people believe that this was actually Paradise. . . .

"Now, no man was allowed to enter the Garden save those whom he intended to be his *ASHISHIN*. There was a Fortress at the entrance . . . strong enough to resist all the world, and there was no other way to get in. He kept at his Court a number of youths of the country, from 12 to 20 years of age. . . . He would introduce them into his garden . . . having first made them drink a certain potion [thought by some to contain hashish] which cast them into a deep sleep. . . .

". . . So when the Old Man would have any Prince slain," Polo continues, "he would say to such a youth: Go

Since 1983 the author has written foreign news for Time. *He is now working on a book about Asia.*

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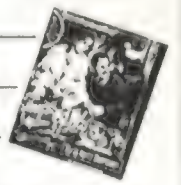

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Like all Shiites, the Assassins held that true succession from Muhammad ran through his daughter Fatima (right) and her sons.

thou and slay So and So; and when thou returnest, my Angels shall bear thee into Paradise. And should'st thou die nevertheless even so, I will send my Angels to carry thee back into Paradise. . . .' And in this manner the Old One got his people to murder any one whom he desired to get rid of."

Modern Islamic scholars point out that there is no proof of the use of hashish by the Assassins. Be that as it may, however, the origins of the group that came to be known as the Assassins lie deep in the complex history of Islam. All Muslims believed, and still believe, that there is but one God and Muhammad is his prophet, chosen agent for a series of divine revelations that resulted in the Koran. But when the Prophet Muhammad died in 632, he left no obvious successor to serve as Imam, the Islamic term for spiritual leader. Most of his followers accepted Abu Bakr, his father-in-law, as Imam. A few, however, were convinced that Muhammad had designated as his successor Ali, the husband of his daughter, Fatima. In time, the former group, favoring Abu Bakr, called themselves Sunnis. Today they account for about 90 percent of the world's 800 million Muslims. The minority following splintered into various gatherings of subsects who believed that leadership must come from descendants of Ali and Fatima. They were, and are, collectively known as Shiatu Ali (the Party of Ali), or more simply, Shiites.

From 656 till 680, the two groups struggled with each other. Gradually, however, those who became Sunnis settled into a position of worldly power under their caliph (sovereign), who ruled first in Damascus and then in Baghdad, while the Shiites came to be a minority opposition. And since in an Islamic state there is no sharp demarcation between religion and politics, the differences between the sects sometimes resulted in bitter political divisions.

As the Sunnis consolidated their hold on power, the Shiites seem to have developed a certain appeal for the discontented of the Islamic world. Shiism included in its ranks many eclectic minority groups. Some held

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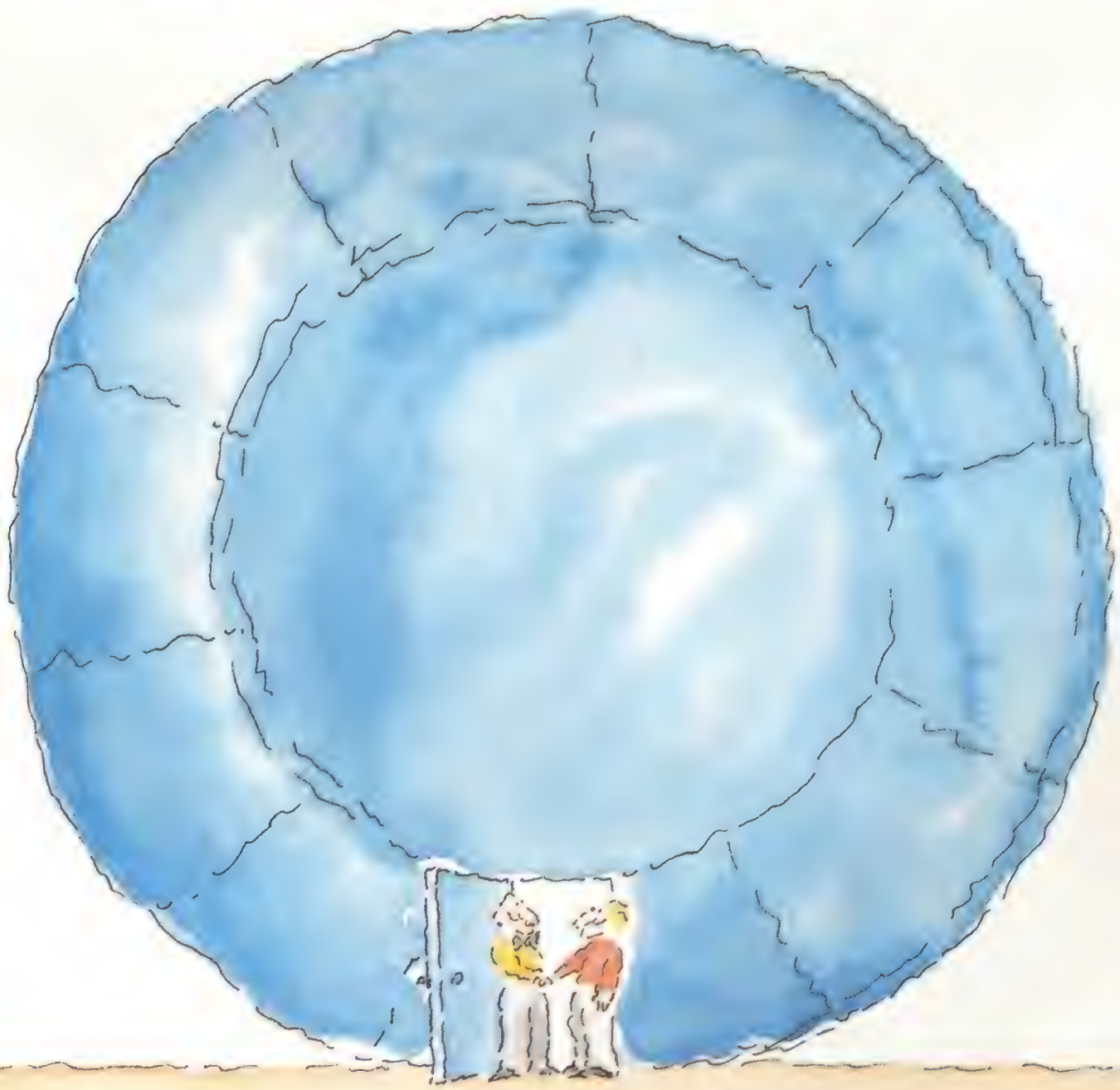

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Gnostic beliefs, some had faith in reincarnation, others hoped for an imminent messiah; early on a few even practiced, as a religious duty, the strangling of enemies with cords. All the heterodox factions, however, were united by a single overarching goal: to overthrow the Sunnis and give to the Islamic world its proper Imam, spiritual heir and divinely appointed successor to the Prophet.

Before his death in 765, the Sixth Shiite Imam, Jafar al-Sadiq, first named his elder son Ismail as Imam, but after Ismail died he named his younger son, Musa. The majority of Shiites accepted this and went on for 113 years, tracing the line of spiritual teachers, through Musa, to a 12th Imam. (In Islam they are called "Twelvers.") But a few believers, who became known as the Ismailis, held that the line of succession for the *real*

Sunnis believed the true successor to Prophet (center left) was father-in-law Abu Bakr (far left).

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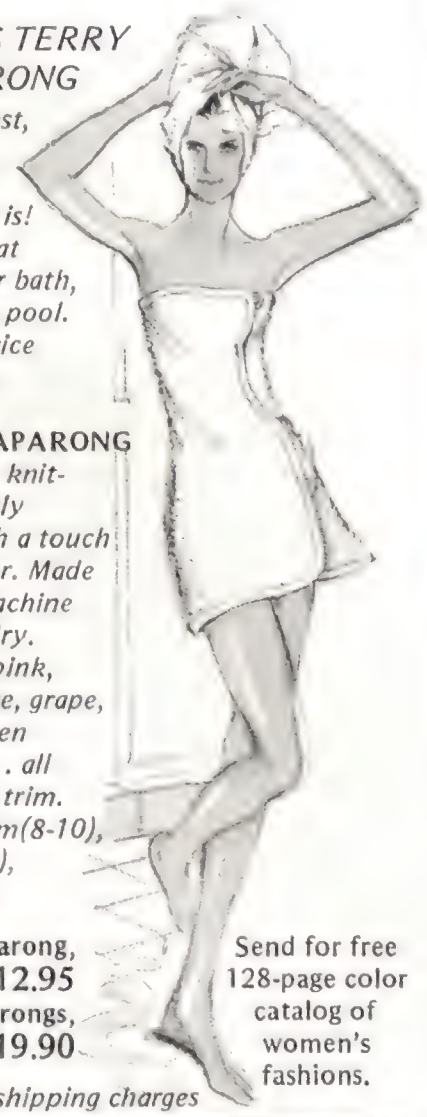

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Imam, their Imam, should have gone through Ismail and his descendants.

As a minority faction within a minority sect, the Ismailis were compelled to devise ingenious tactics to survive and contend for power. One precautionary device was to maintain that *their* Imam might choose to remain in hiding, only to reveal himself at a later date. This notion was in turn supported by the principle of *taqiyya* (for "precautionary dissimulation"), which allows Muslims, if under threat, to deny their specific faith. Thus an Ismaili, when embattled, could protect himself by pretending to be a Sunni.

Ismailis believe that though revelation stopped with the Prophet's death, spiritual guidance is necessary for the faithful. It is provided by the Imams who are infallible and whose commands must be obeyed, at least with regard to the Koran. The young sect gathered momentum swiftly. By 910, an Ismaili Imam named Ubaidallah was proclaiming himself caliph, this time in the name of Ali and Fatima, the Prophet's daughter. Gradually a Fatimid Empire spread across North Africa, Arabia and Syria; as its capital the sect created the glittering cosmopolitan city of Cairo, soon renowned for magnificent gardens and bazaars, well-stocked libraries and well-ordered streets. It now seemed possible that the Fatimid Caliphate might overmatch the Sunni Caliphate in Baghdad. But the Sunnis had made converts among the tough Seljuk Turks, who upheld Sunnism partly in order to help maintain a certain political unity in the Islamic heartland. Eventually, in 1171, a Sunni warrior named Saladin, in the process of trying to unite Syria and Egypt, toppled the Fatimid Caliphate and took power in Cairo.

By that time, however, the Ismailis divided over the question of which son, Nizar or al-Mustali, should succeed a Fatimid caliph who died in 1094. In time the followers of al-Mustali more or less withered away. But the militant followers of Nizar flourished, proclaiming a doctrine known as the New Preaching which sometimes, fundamentalist critics say, emphasized the role of the living Imam, even at the expense of the original intent of the Koran. For all Nizari Shiites thereafter, their Imam was the *true* Imam and all others imposters. The quarrel between the two brothers created a bitter new rivalry that helped the Assassins grow.

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Historically the arch-Assassin was a man named Hasan-i Sabbah. Born around the middle of the 11th century, the future founder and master of the Assassins grew up in Persia, a devoted Shiite and a studious youth. At the age of 17, he happened to meet a teacher, Amira Zarrab, who urged him to turn his eye to Ismaili texts.

After he had nearly died from a wasting disease, Hasan decided that God was advising him to change his ways. He converted to Ismailism in 1072 and later set out on a roundabout pilgrimage to an Ismaili religious center in distant Cairo.

When he reached the city in 1078, the wayfaring scholar was greeted by some of the top Ismaili officials; within three years, however, his independent disposition landed him in prison and later got him deported.

For nine years, often dressed as mendicants and holy men, Hasan and a few fellow missionaries, known as *dais*, traveled the deserts and mountains of Persia, preaching Hasan's own brand of Ismailism, which allows the true Imam to interpret spiritual laws Sunnis tend to regard as fixed. Hasan—erudite enough to command respect, yet magnetic enough to win devotion—was the perfect catalyst for a shift in faith. Many people pledged themselves to the new creed of justice and redemption.

In time he began to concentrate on the rugged highlands of northern Persia, around Daylam. Both the inhospitable terrain and the hardy hill people were well-suited to resistance against what Hasan regarded as the unlawful authority of the Seljuk Turks. All he needed now was an impregnable sanctuary.

High atop the Elburz Mountains, on a lonely ridge 6,000 feet above the sea and circled by eagles, stood the castle of Alamut. Commanding a royal view of the valley below, accessible only by a single, almost vertical pathway, the remote fortress was an ideal hideout and headquarters.

It was also occupied. Undaunted, Hasan executed his first strategic masterstroke. First, he sent a *dai* into the castle to begin converting its residents. Then, on September 4, 1090, the leader himself stole into the stronghold in disguise. A little later, the reigning lord of Alamut found that his subjects were ignoring his orders in favor of another's. Hasan, in the manner of a human Trojan horse, had taken over. The displaced ruler was left with no option but to accept his usurper's generous draft for 3,000 gold dinars and leave the place in the hands of the Assassins.

During the next 33 years, Alamut served as sanctuary and symbol for Hasan's solitary rule. Throughout his stay, he lived in a tiny house; only twice, it is said, did he venture out—on both occasions to visit the roof. Much of the time he simply buried himself in books about theology, geometry, astronomy and magic. Even

The Assassins killed and proselytized all across the Middle East. Alamut was Hasan's stronghold; Kahf, the Old Man of the Mountain's.

the Sunni chronicler Rashid al-Din, no friend of the Assassins, acknowledged that Hasan "lived an ascetic, abstemious and pious life."

To strengthen Alamut, he developed an irrigation system for nearby fields, recruited scholars and built fortifications. New followers migrated to the valley, enough of them to be regarded as a threat by the Seljuk establishment. At the same time, Hasan sent *dais* scattering around Persia. Soon the order had set up all but unbreakable strongholds among the dispossessed people of Quhistan in the southeast and among the disaffected mountain dwellers of the southwest.

Within the castle, Hasan then gathered a group of healthy young fighters. Trained in the strictest secrecy along Spartan lines unlike the languors suggested by Marco Polo, the fraternity received a broad education in languages and the use of daggers, in etiquette and swordsmanship. They were also subjected to an almost monastic discipline: food was as plain as possible. Hasan banished all drinking in the castle, on penalty of death—when one of his two sons broke the rule he was executed as an example. Even the playing of a flute was forbidden. Thus did the zealots of Alamut swiftly learn that their Master's word was truth, his wish their command. Hasan fashioned a corps of devotees as sharp and unquestioning as the knives they wielded, and as deadly.

He now had at hand a powerful tactical weapon. According to legend his first significant victim was no less than the Grand Vizier, Nizam al-Mulk, chief administrator for Sultan Malikshah, the Seljuk ruler of Persia. The Grand Vizier had been denouncing the legitimacy of the Alamut reign and seemed ready to crush it. In response, the story goes, Hasan selected one of his most accomplished fighters and sent him to Nizam al-Mulk dressed as a holy man with a petition. One night, as the Vizier was being carried on a litter to his harem, Hasan's agent stepped suddenly be-

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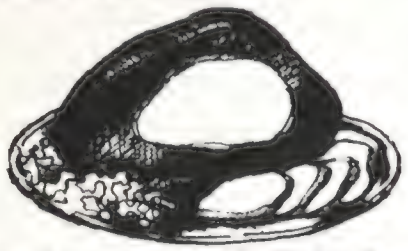

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fore him, drew forth his dagger and plunged it into the Vizier's heart. "The killing of this devil," Hasan is said to have declared, "is the beginning of bliss."

Many scholars contend that Malikshah himself may have had his Grand Vizier killed because he was becoming too powerful, and then blamed it on the Assassins. In either case the killing confirmed Hasan's fearsome reputation—and tactics.

Hasan soon realized that one flawlessly conceived attack could achieve as much as a battle. ". . . by one single warrior on foot," wrote an Ismaili poet, "a king may be stricken with terror, though he own more than 100,000 horsemen." Selecting his victims carefully, Hasan picked off at least 50 leading opponents—sometimes paralyzing the will of a hostile community by taking the life of its military commander or principal divine.

The practice was made all the more relentless because of its religious underpinning. To the Assassins, these attacks were not wild and wanton outbursts of violence, but hallowed acts of justice, performed deliberately and only with a dagger that had been blessed by the Master. Nor were the executioners regarded as criminals. All Muslims are promised paradise if they die in the Holy War for Islam, but Assassins killed in action were also regarded as martyrs who had earned a place on a special honor roll kept by the Master. It was no coincidence that the dagger men were called *fidais*, or the "faithful."

So fierce and consuming was the legend of their loyalty that it became proverbial: a medieval suitor would swear to his beloved that he was "faithful as an Assassin." The killers sought no personal gain from their acts; indeed, some hoped to pay for their missions with their lives. To survive an assault was often seen as tantamount to failure. One Assassin attack, according to the Aleppine historian Kamal al-Din Ibn al-Adim, culminated in the death of seven of the

Saladin, Islam's leader during the Crusades, became an Assassin target.

eight *fidais*. When she heard of this, the mother of one of the assailants "rejoiced and anointed her eyelids with kohl. . . ." But when her son returned home and she realized that he had been the survivor, "she was grieved, and tore her hair and blackened her face."

Thanks to their dissembling policy of *taqiyya* and their skill at disguise, Hasan's men were difficult to identify and hard to break; most would rather die than betray their colleagues. And, as their reputation grew, the threat of killing sent fear into the heart of every enemy. Hasan sometimes waited years to take his revenge. Opponents of the Assassins came to know that anyone—a trusted attendant, the man next door, even a holy supplicant—could suddenly prove to be a dagger-wielding Assassin. The prospect of such an attack could be as crippling as an attack itself: some rulers barricaded themselves at home; others turned against innocent courtiers. The Assassins so poisoned the minds of their contemporaries that their hand was often seen in the deaths of individuals they could not have possibly killed.

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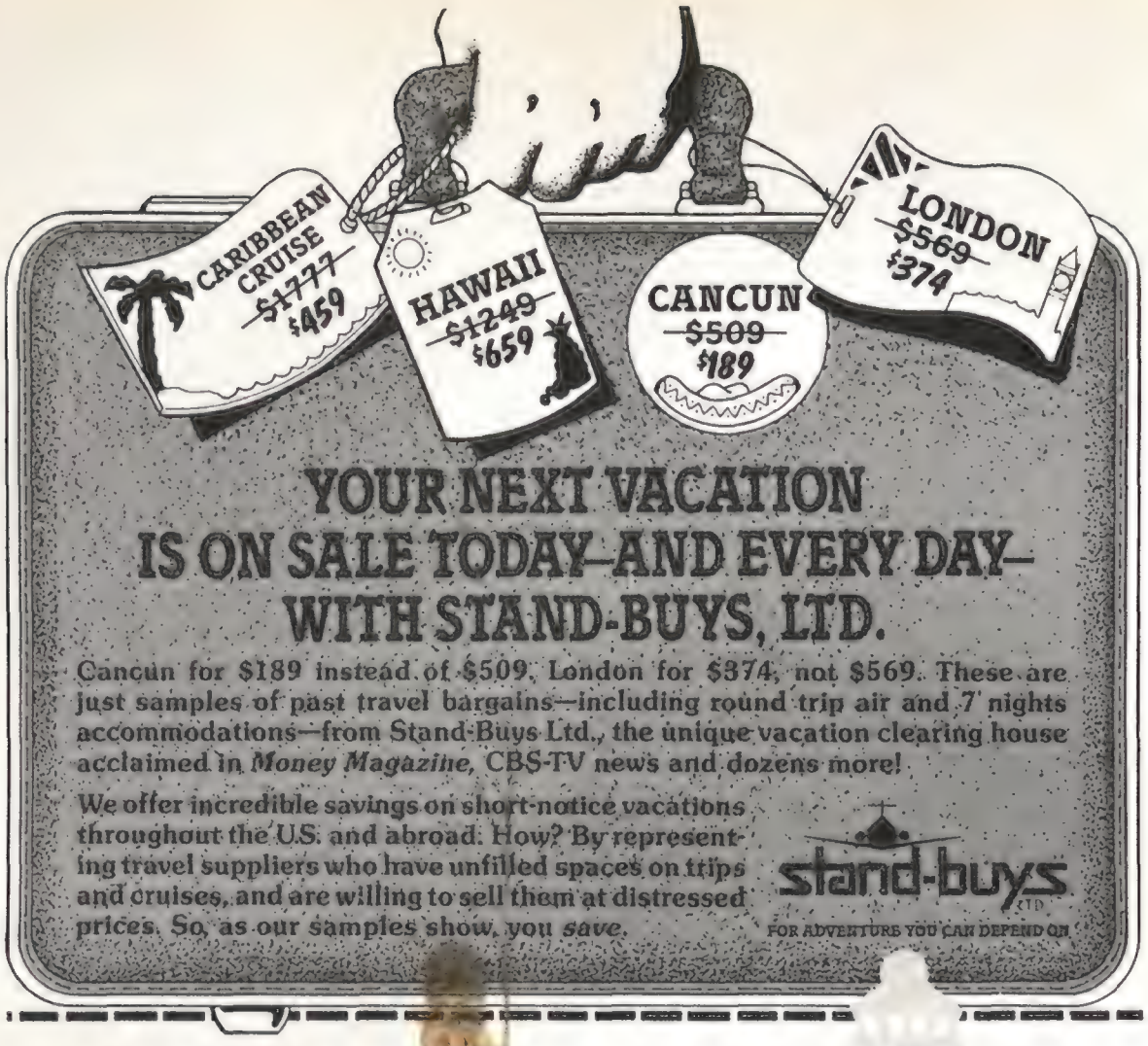
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Grand Vizier Nizam al-Mulk been cut down than Sultan Malikshah died too, leaving the empire of the Seljuk Turks leaderless and in disarray. So also when some years later another sultan resolved to starve the order out of Alamut by destroying all its crops and fruit trees, that sultan died too, just as Hasan's men were about to give in. The siege was broken off.

As soon as the new sultan, Sanjar, began rebuffing Hasan's offers of peace, it seems he was treated to a crash course in Assassin tactics. One night, an accomplice of Hasan's crept into Sanjar's tent while he slept and plunged a dagger into the ground by his side. Later, a message arrived from Hasan: "Did I not wish the Sultan well that dagger which was struck into the hard ground would have been placed in his soft breast."

Sanjar got the point and acted accordingly. When he sent envoys to negotiate with the chieftain of Alamut, legend has it that they in turn were given a simple demonstration of the Master's power. At the audience, the story goes, Hasan spoke one word and a young devotee at his side pulled out his dagger and slit his own throat. He issued another signal and another initiate instantly hurled himself over the ramparts to his death. Sixty thousand others, Hasan told the Sultan's emissaries, were prepared to do the same. At that, Sanjar's men agreed to sign a treaty of peace.

In 1124, the order suffered its first great setback—Hasan fell ill. Having executed his only remaining son because he had arranged for the death of a fellow Assassin, he had no sons left to succeed him. His command, therefore, fell not to one of his own kin but into the hands of a veteran fighter called Buzurgumid.

Under the leaders who followed Buzurgumid, the sect continued its policy of killing Sunnis and rival Fatimid Ismaili leaders while preaching rebellious religious theory. In 1127, after the sultan's Grand Vizier led another attack on Alamut, two

fidais got into his service as grooms, and one day stabbed him to death while in the stables. Three years later, in far-off Cairo, ten Assassins leapt out of the bushes and cut down the Fatimid caliph. Then in 1139, two-dozen executioners did the same to the caliph of Baghdad.

Though the honor roll of assassination continued to lengthen, the sect gradually became more and more involved in savage local squabbles. But the Assassins lost none of their cunning. Under Muhammad II, the fourth succeeding leader after Hasan, a *fidai* was sent to the learned Sunni theologian Fakhr al-Din Razi, one of Ismailism's most formidable spiritual opponents. For seven months, the Assassin diligently audited Razi's courses. Then, one day, he asked the great scholar whether they might discuss a tough theological question in private. Hardly had Razi assented than the agent pulled out his dagger, sat on the theologian's chest and demanded that he retract his religious views. The request was even harder to refuse because the Assassin also offered a bag of 365 gold dinars. Never again did Razi speak against the Ismailis. When a student once asked him why he had undergone such a change of heart, the professor wryly observed that Ismaili arguments were "both weighty and trenchant."

Even as the Assassin movement was losing momentum in Persia, it became known to Europeans for the first time because Hasan had sent representatives to the mountainous parts of Syria to acquire fortress bases. Syria, like modern Lebanon, was then a hornet's nest of sects and subsects and factions, a gallimaufry of Christian dissenters, heretics, Fatimid Ismailis and such breakaway Shiite sects as the Druzes, who to this day figure in the struggle that goes on around Beirut. Among the people of the mountain valleys Assassin *dais* found a willing audience.

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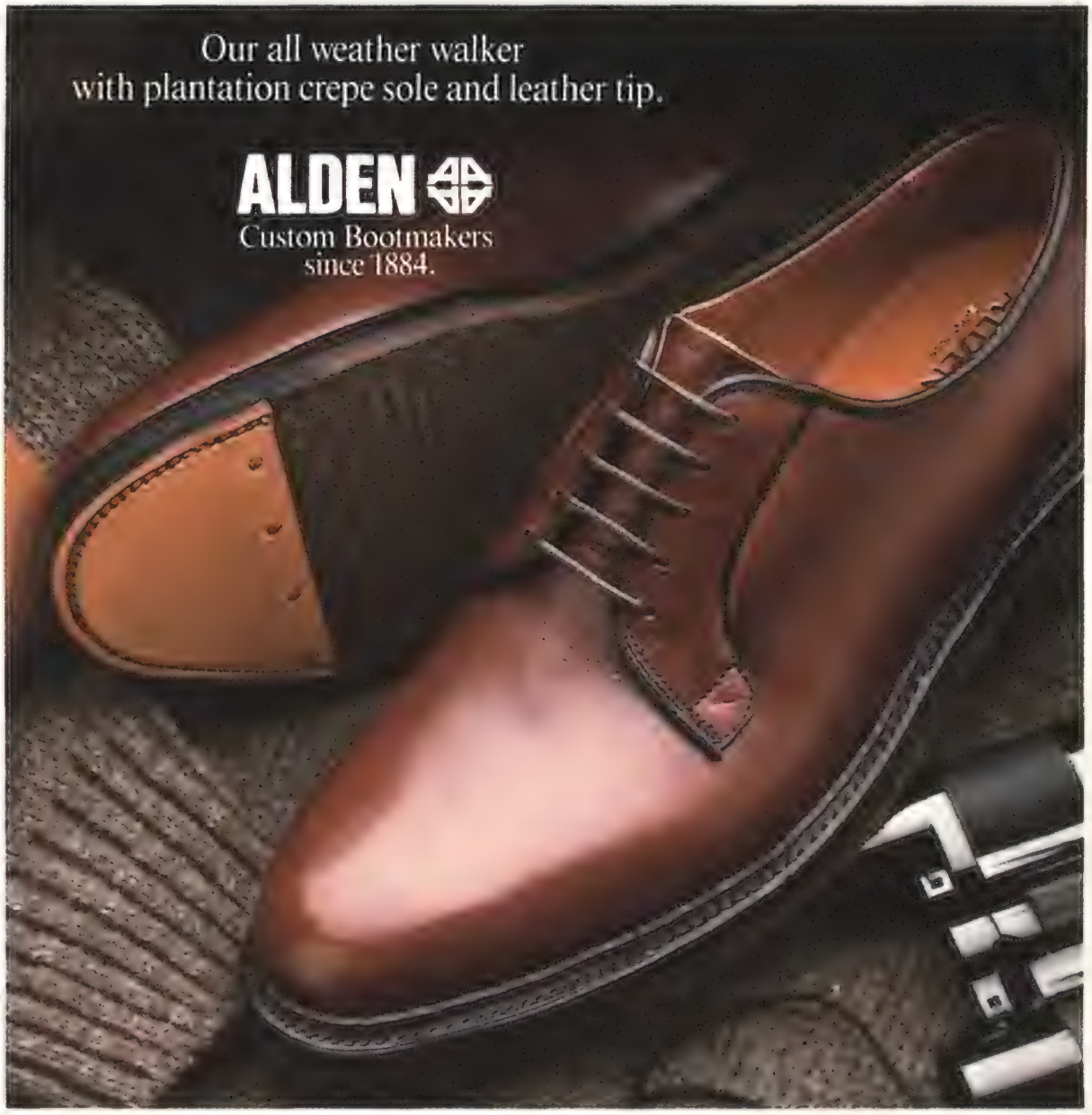

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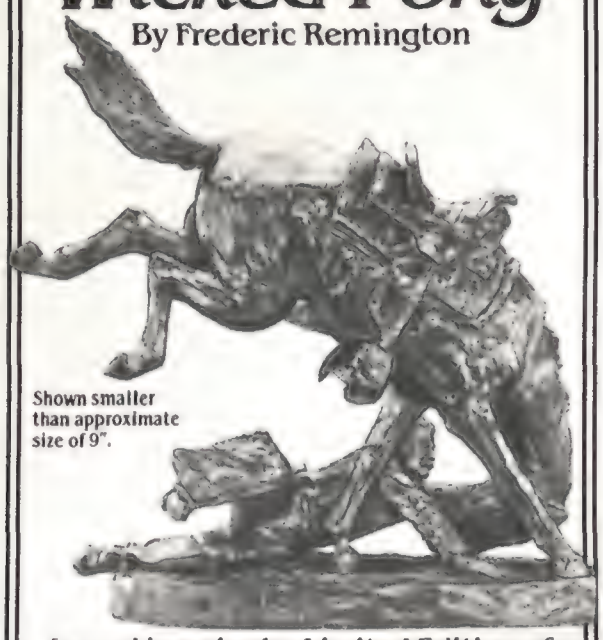

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in Syria was Sinan ibn Salman ibn Muhammad, who took over a cliff-hanging castle at Kahf in 1162 and was called by the Crusaders the "Old Man of the Mountain." Sinan managed to strengthen his position until the Syrian Assassins were almost independent of Alamut. So strong and celebrated did he become, that maps of the Middle East during the Crusades included a large, roughly triangular area in the mountains behind the Syrian coast marked "Country of the Assassins."

Even during the centuries of the Crusades, when fierce European knights and nobles were carving out Christian kingdoms on the eastern shore of the Mediterranean and inland toward the Holy City of Jerusalem, local Assassins still chose to concentrate on the killing of Orthodox Sunni soldiers and spiritual leaders. Twice they even tried to kill Saladin, the Sultan and ruler of Egypt who—though he had overthrown the Fatimid Ismaili Caliphate—strove from 1174 to 1192 to unite nearby Islamic peoples against the Crusaders. He survived, but only because he resorted to avoiding contact with strangers and sleeping in a special wooden tower. It was not until around 1150 that the Ismaili Assassins claimed their first Christian victim, Count Raymond II of Tripoli, thus doing away with an enemy of Islam. At one point two *fidais*, pretending to be Christian monks, dispatched the then king of Jerusalem, Conrad of Montferrat. Under torture of slow fire and flaying, one of the dagger men claimed that he had been hired for the task by Richard the Lion Hearted. Although the Assassin may have been dissimulating, his story gained credibility when Richard's protégé, Count Henry of Champagne, married Montferrat's widow and took over his domain.

If Assassins actually did work on behalf of Richard, it certainly marked a betrayal of the order's guiding principles and was a sign of the decline that eventually did set in. Where once the Assassins had been devoted believers willing to pay any price to protect their faith, they gradually lowered their standards. After Sinan's death, more and more *fidais* took to serving local rulers as security guards or free-lance hit men.

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The Assassins, however, never seem to have concentrated heavily on attacking the Crusaders. Around 1174, in fact, Sinan attempted a rapprochement with the Kingdom of Jerusalem. To that end, it is said, he promised that his entire sect would convert to Christianity.

The deterioration of the sect in Persia became more and more pronounced, too. As lord of Alamut, Jalal al-Din Hasan pledged his loyalty to the Sunni orthodoxy in 1210. To convince doubters that he was not simply exercising *taqiyya*, he even allowed the works of Hasan-i Sabbah to be removed from the castle's great library and burned.

Alamut's final collapse came in the middle of the 13th century, decades after Genghis Khan and tens of thousands of Mongol tribesmen had thundered across the plains of Central Asia into the Middle East. The

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Yet a remnant of the resilient sect somehow found a way to survive. Shorn of power and little known, at least to the Western world, for centuries they rallied around Rukn al-Din's son and generations of his successors. They came to public notice in Europe and America again only in the 1830s and '40s, when the head of the order led uprisings against the Shah of Iran and found himself obliged to move to India with many of his followers. Earlier, the Shah had conferred on him the worldly title of Aga Khan (or, roughly, leader). In Bombay he found a group of Indians known as Khojas, who had been converted to Ismailism in the 13th, 14th and 15th centuries. Some refused

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their allegiance to the Aga Khan and some killings occurred.

The dispute eventually required the British-Indian authorities to conduct a trial and search out the Ismaili line of succession for six centuries back, finally declaring the Aga Khan's title bona fide. To this day, the Ismailis (claimed to be 12 to 15 million in number) still take as their Imam the fourth (and present) Aga Khan, a handsome, benevolent, pin-striped Harvard man who lives in Europe and visits his people in a white private jet. It is a sign of the times that after he was installed as God's agent on Earth in 1957, the Aga Khan was serenaded by a Boy Scout band playing "Way down upon the Swanee River."

It has been centuries, of course, since the Ismailis have had anything to do with organized killing. Emphasizing the balance between spiritual values and good works, they are now a pragmatic, law-abiding group that stresses success in business and the professions. Ismaili scholars emphasize that the tactics of the Assassins are not typical of Ismaili culture. They point with pride to Ismaili contributions to scholarship and social development throughout their history. In addition to founding the city of Cairo, they established the University of al-Azhar and an academy of science in Egypt. Renowned philosophers, jurists, mathematicians and scientists have flourished under the patronage of Ismaili Imams.

The Aga Khan Foundation, to which many Ismailis contribute, spends more than $60 million a year on health, education and rural-development projects in Asia, the Middle East and Africa. Last November the $300-million Faculty of Health Sciences at the Aga Khan University opened in Karachi. A program at Harvard and MIT, funded by the Aga Khan, offers a master's degree in design for Islamic cultures. And his Award for Architecture is given every three years for up to $500,000—making it the world's largest.

The Assassins have long disappeared into history. Yet there is still abroad in many parts of the world the illusion that murder committed for religious or political purposes is an ennobling act. Just before his death, Hasan-i Sabbah whispered to his attendants, "Remember: my spirit is vigilant."

In 1258, two years after he had smashed the Assassin stronghold at Alamut, Genghis Khan's grandson Hulegu successfully laid siege to the city of Baghdad.

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By Michael Kernan

West Virginia's youthful curators of local history

Joseph and brother Manuel don miners' hats from collection; a miner showed them how they work.

Going from hubcap to historical museum, a pair of brothers barely in their teens could teach even Tom Sawyer a trick or two

Joseph Nevera, 13, and his brother, Manuel, 11, of Hazleton, West Virginia, own a museum.

It started with a hubcap.

"We were driving to town and Joe saw this hubcap by the road," his father says, "and he pestered me and pestered me until I finally turned around and picked it up. So then later on we stopped off at a flea market and before I knew it, he'd sold the thing to the guy for $5."

This was five years ago, mind you, when the brothers were 8 and 6. They started collecting things, miscellany found by the road, odds and ends that relatives gave them, trading and buying stuff that caught their eye. They discovered that you could get a penny for a used aluminum can, so they roamed up and down the highways and haunted dumps for cans.

"I can still see that little 6-year-old dragging a bagful of cans bigger than he was," his father says. In one year they made $1,000 from the cans.

Eventually their father, Joseph sr., a real estate entrepreneur, auctioneer and flea market operator, built them a museum. It was actually a 200-foot-long shed that would someday become the warehouse for his market operations, erected on the 132-acre hilltop lot near Hazleton where he is building the family's new home.

Like most collections, boys' is only partly displayed. In storage shed, artifacts are sorted, extras sold.

The boys took over one end of the shed for their American Historical Museum and currently are using the other 170 feet of it for storage and sales (opposite). That's where they hang their 2,500 hubcaps from the rafters. That's where they keep the stacks of old magazines and books, the coal stoves and picture frames and stone jugs, the supply of ax handles, used tarps, highway signs, saws, ornamental corncobs, dozens of still-unopened cartons of stuff they bought sight unseen and their 80-pound Civil War cannonball.

It is a jumble, and the jumble is awesome. But in the museum proper, all is order and serenity. The boys will give you a guided tour when you visit there on a Sunday (except in winter) and pay your 50 cents.

The star of the show is an 1880 stagecoach, which now stands next to a well-preserved fringe-topped surrey of the same vintage. The coach is supposed to have run between Parsons and Davis, several miles south, and later to have taken patrons to the Cottrill Opera House in nearby Thomas, before World War I.

"Our dad found them in a garage in Thomas," says Joseph. "We went over and took a look at them and made an offer." He won't say what the price was but it was "very good."

The brothers explore the old coach with a visitor, pointing out the "Pittsburgh" label on a wheel hub ("See, that's where it was made," Manuel says. "No, no, that's just where the axle was made," his brother snaps) and on the rear of the surrey, the steel label that says "Wheeling W. Va." The coach's windows are of thick beveled glass, and both vehicles sport cut-glass lanterns that must be worth quite a bit by themselves.

The boys may not know much about the history of the carriages, but they know their way around them. Under the seat of the surrey they even found a maga-

Photographs by Robert C. Lautman

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On display, stuffed pheasant perches at top with out-of-state license plates; below are Model T wrenches and some of boys' 100 different beer cans.

zine rack and, at the rear, a hidden compartment for baggage. One feature that gives them particular proprietary pride is the step cover. When you close the door, a horizontal iron sheet protruding from its base automatically covers the passenger step, keeping it free from ice and slush on the road.

But there are other things to see here. A collection of license plates from more than half the states has been gradually accumulating as a result of Joseph's letters to all 50 governors of the United States. Some old tools custom-made for Model T Fords are neatly arrayed on a table, along with a wooden dipstick for gasoline, dated 1909. That was evidently before cars had built-in gas gauges. There are also some coal miners' metal hats and lamps that the boys bought at a local flea market. Also a stuffed raccoon, a chipmunk and a pheasant that a cousin sold them.

Not to mention a convivium of

Michael Kernan is a Washington Post *writer and* SMITHSONIAN *contributor who explores the world's museums.*

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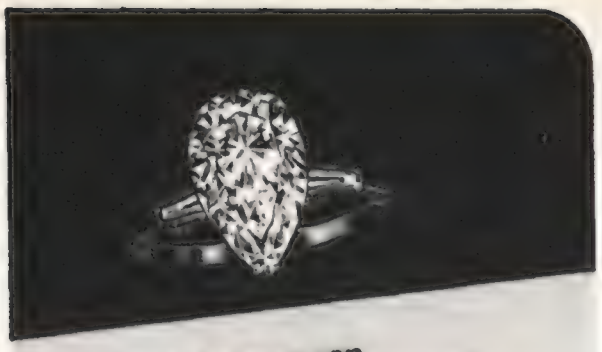

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Museum's treasures include railroad kerosene torch, early 1900s (top left); cagelike Bingo tumbler (top right); trapper's skinning tool (bottom right).

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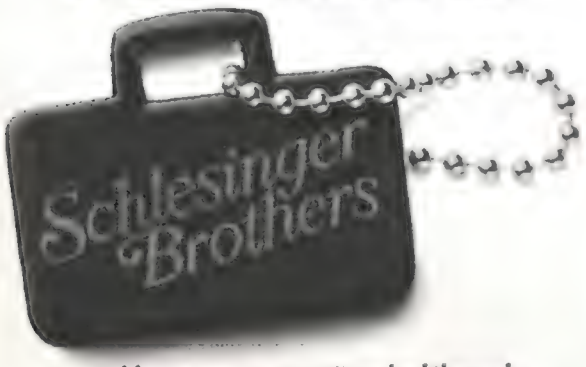

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Boys chiseled 300-million-year-old fossil seed-ferns from strip mine.

Some items are quite fine, Nevera senior says, notably an early cradle scythe in almost perfect condition. But the father keeps out of his sons' way and lets them do all the talking—except when he obviously can't stand it anymore.

The family lives in Morgantown, nearly 30 miles away, but the boys go to school at Bruceton Mills because it is closer to the new home the family is building. Every school afternoon the parents bring them to the museum and new homesite before returning to Morgantown. Joseph is in the eighth grade, Manuel in the sixth,

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and both are high-B, low-A students, their mother, Eleanor, says with parental pride.

"We had been thinking about a museum for three years," Joseph explains. "We started putting things in here a year ago. We bought stuff from people and traded, and we go to all the flea markets and yard sales."

Last year they appeared on local TV in connection with the letters they wrote to the governors, and since then it seems that just about everyone in Preston County who has something to sell or something to give away calls the Nevera boys.

"Last summer we had 300 people at the museum," Manuel says. "We do it all with our own money. When we get an old hammerhead or axhead and we already have one in the museum, we put a new handle on it and sell it."

Both of them have the same ambition: to be auctioneers or museum curators. They say they learn a lot from what visitors tell them about their exhibits. Once an ex-miner demonstrated the fine points of a mining helmet to them.

Eagerly showing their treasures to anyone who will spend the time, the Nevera brothers seem determined to learn everything they can, any way they can. The great world beyond West Virginia beckons.

The Nevera brothers sit on driver's seat of an 1880 stagecoach that is museum centerpiece. Used in West Virginia, coach has sidelights for night travel.

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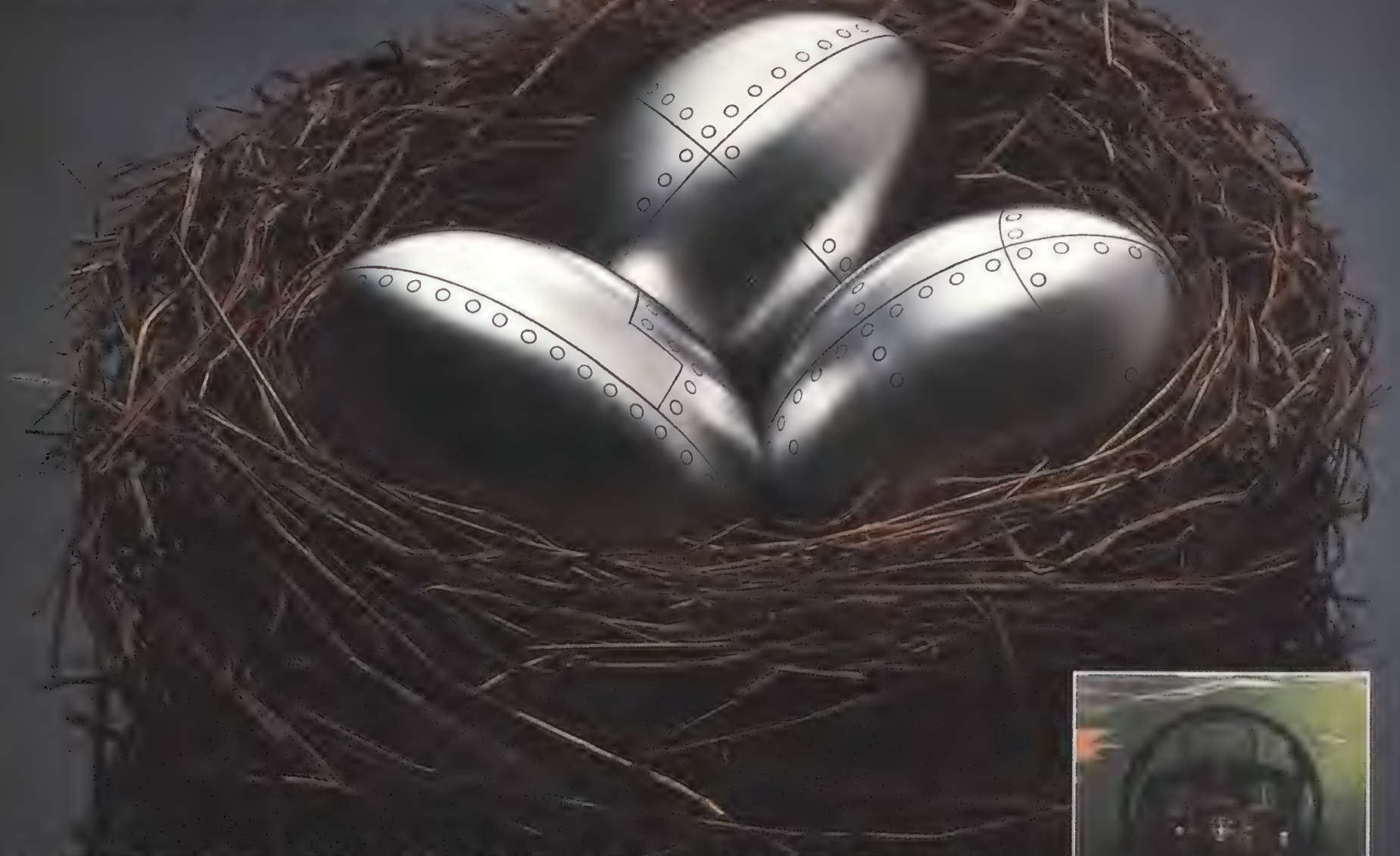

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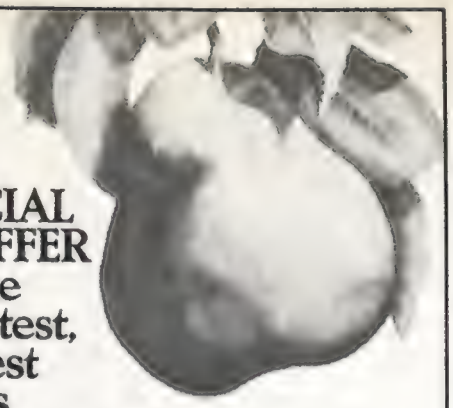
Book reviews

The Penguin Encyclopedia of Horror and the Supernatural
Edited by Jack Sullivan
Introduction by Jacques Barzun
Viking, $35

This first-of-its-kind reference book is not one likely to gather dust on library shelves. It's an eclectic and fascinating guide to (what its editor calls) "a genre in which the scholarly and the popular, the sublime and the ludicrous, the fanatically refined and the crassly commercial, all exist side by side. . . ." Connoisseurs of "classic" ghost-story writers like Montague Rhodes James and Joseph Sheridan Le Fanu will find intelligent considerations of these masters' strategies and subtleties. And aficionados of "camp horror movies" and other quotidian entertainments should appreciate the many unabashed appreciations of "the uncomplicated, strictly nonintellectual pleasures" offered by such charming ephemera as *Dracula's Dog*.

The book's range and its variety of tones and approaches are agreeably broad. Major writers and consensus classics (Mary Shelley's *Frankenstein*, Bram Stoker's *Dracula*) indeed receive extended treatment, but there's also strong emphasis on neglected or little-known quality writers (Oliver Onions, the superb Scottish tale-teller James Hogg, the young American novelist Jonathan Carroll) and on mainstream authors—William Faulkner, Jorge Luis Borges and William Butler Yeats are examples—who've occasionally written in this vein. There are entries on horror films of all stripes and also on directors and actors who specialized in them.

Other subjects include composers of "the music of terror" (Béla Bartók, Franz



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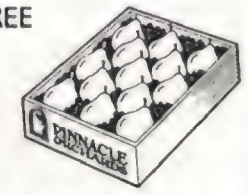

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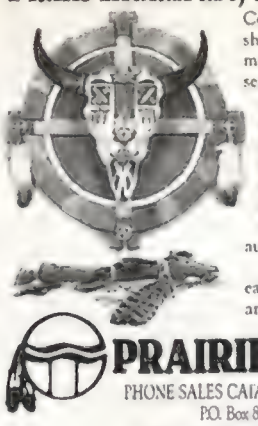

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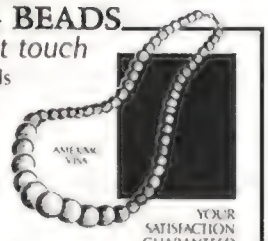

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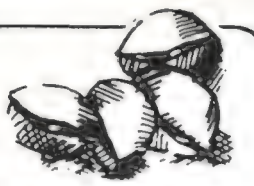

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Liszt and Alexander Scriabin—but also accomplished movie-score writers Jerry Goldsmith and Bernard Herrmann) and artists from William Blake and Gustave Doré through Edward Gorey, Gahan Wilson and the legion of illustrators known mostly for their work in popular fantasy magazines (the *Encyclopedia* itself, incidentally, is lavishly and attractively illustrated throughout).

Approximately 50 longish theme essays (on, for example, "Romanticism," "Opera," "The Continental Tradition," "Writers of Today") function as illuminating surveys of potentially intractable materials. Several are particularly rich and entertaining, including Colin Wilson's knowledgeable tribute to "Werewolves" and T.E.D. Klein's thoughtful rumination on "The Supernatural" as perceived and experienced by the writer.

Of the 66 contributors, the obvious best are editor Sullivan, the English scholar Julia Briggs and that tireless toiler in the field, Everett F. Bleiler (the doyen of Dover paperback reprints); their colleagues' efforts vary wildly in quality (and often offer conflicting opinions). Generally, all refrain from making extravagant claims for minor or limited works—though excessive credit is given to such dated, mannered writers as Clark Ashton Smith and Barry Pain, and the canonization of the extraordinarily successful Stephen King seems, to put it mildly, premature. On the other hand, Daphne Du Maurier's fine stories are undervalued and there are only perfunctory discussions of Charles Dickens, Mary E. Wilkins Freeman and the Norwegian writer Jonas Lie, all of them important and seminal.

If too many of the summaries of stories and movies give too much away (suspense and surprise being, after all, of the essence), we at least learn which of the genre's dozens of buried delights really are worth digging up.

It's tempting to speculate on the reasons why so many people so enjoy the occasional good scare (Jacques Barzun does so, in his elegantly written introduction, "The Art and Appeal of the Ghostly and Ghastly"). I suspect it's some combination of the vicarious-thrill-voyage-outward from which we confidently anticipate safe return, and the vague apprehension of dimensions different and beyond, which alternately beckon and threaten. Whatever moves you to pick up *The Penguin Encyclopedia*, be forewarned that its contents are seductive and addictive; it's an altogether alarming and delightful book.

Bruce Allen
Literary critic

Tone Deaf And All Thumbs?
An Invitation to Music Making
for Late Bloomers and Non-Prodigies
Frank R. Wilson
Viking, $15.95

Somewhere around San Francisco, says Frank Wilson, a woman in her 90s sits at an electric organ, earphones clamped to her head, playing away day and night, ignoring the pots burning on her kitchen stove. She took up music at 88. And why not? Anyone can make music, Dr. Wilson contends, and it's never too late to start. Playing a Bach canon isn't too different from tying your shoelaces.

Dr. Wilson, a neurologist who began piano lessons at 40, maintains that "the special nature of the human brain and the phenomenal muscular system to

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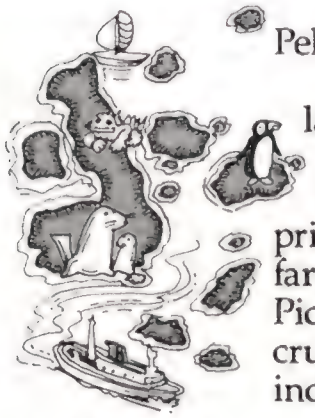

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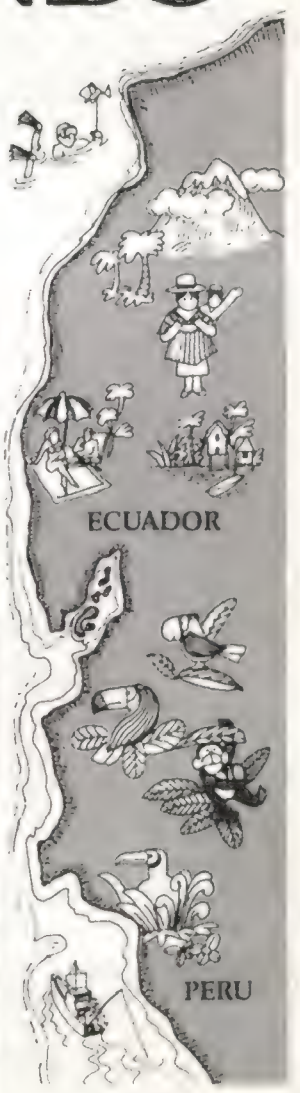

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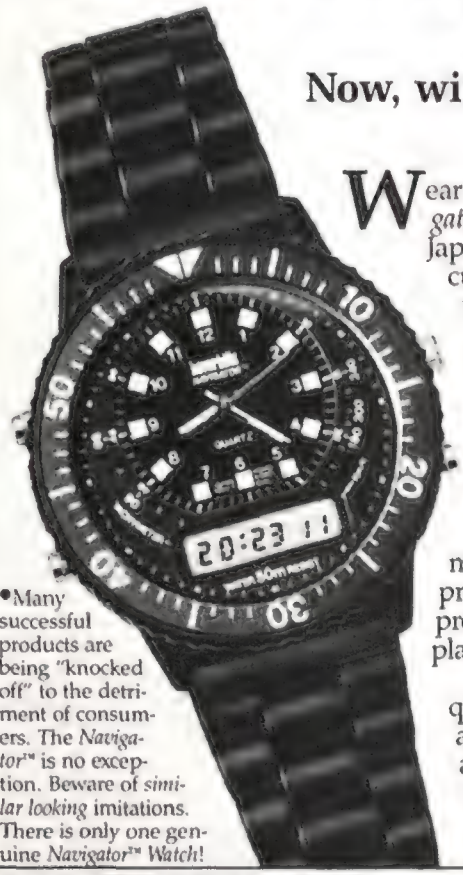

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which it is attached" guarantee all humans an inborn musical ability. (Whether they play well or hideously doesn't matter; the fun lies in just doing it. A lack of talent, after all, is more painful for the audience than for the performer.)

Tone Deaf And All Thumbs? is an attempt to describe the neurological basis of music—how the eye, the brain and the body take a note from the page and transform it into sound, how we hear, how we deal with rhythm and tempo. What goes on inside a pianist playing Schumann's rapid-fire C major Toccata, Opus 7, involving *some 400 to 600 separate motor actions per second* (not counting the motions of the wrist, forearm, shoulders or feet)? What is "the neuromuscular/audiovisual/biomechanical apparatus" brought into play when someone picks up a flute?

The questions are fascinating, particularly for countless would-be musicians. But in a way the book is a disappointment. Much of it reads like TV talk-show patter, relentlessly cute, riddled with snappy remarks about Uncle Irving and the family cat. Much of it deals with basal ganglia and Betz cells and phase differences and visual-spatial competence, all in a fashion more likely to produce indifference, if not paralytic boredom, than to set the feet tapping. Anatomic and physiologic arrangements may be gripping to neurologists but hardly seem the stuff of Rubinstein or Dizzy Gillespie or Linda Ronstadt. Wilson never really manages to explain how it all works, either. There simply is no way of knowing what the brain cells are up to, he concedes, when you play "Three Blind Mice."

What Dr. Wilson does manage well is to persuade us that making music is largely a physical activity, and at a time when middle-aged Americans are putting on running shoes and taking up tennis or jogging, dismissing the risk of ridicule, there's no reason they shouldn't try a little Mozart. A violinist has much in common with a wrestler, he argues. Instead of using their large muscles, however, as athletes do, musicians use small muscles—in the fingers and the mouth and so on.

None of this, of course, explains how real musicians transform the mere noise of an instrument into real music; how they make the notes soar and sing. That is an awesome thing, as Dr. Wilson knows. He tells of how, when practicing Debussy's *The Sunken Cathedral*, the "pi-

ano unexpectedly yielded a sound I had neither heard nor even imagined before. I felt almost as though the piano and I were going to float right out the window. . . . I played the chord again several times to make sure my ears hadn't deceived me, then went outside and looked at trees for an hour or so."

That's a familiar sort of sensation to anyone truly smitten with music—proof, if proof were needed, that music isn't all brain and muscle. The gods have a hand in it, too.

David Lancashire
Globe and Mail, Toronto

Captain Kidd and the War Against the Pirates
Robert C. Ritchie
Harvard University Press, $20

This is the worst news I've had since Bruno Bettelheim psychoanalyzed Little Red Riding Hood. There is no pirate treasure on Oak Island or Block Island or in the Hudson Valley or somewhere in the Florida Keys or Nova Scotia or the South China Sea.

"The men who turned to piracy did so because they wanted money," author Ritchie says. "As soon as possible after capturing a prize they insisted on dividing the loot, which they could then gamble with or carry home. The idea of burying booty on a tropical island would have struck them as insane, especially since all the men on board would demand to know the 'secret,' which would then be no secret."

Methodically, heartlessly, Ritchie accounts for most of what was known to be Captain Kidd's loot, which may have reached 400,000 pounds sterling at one time. A good chunk of that was supposed to have gone down with the *Quedah*, one of his ships, which he left behind in the West Indies. But the *Quedah* was burned, as the author shows, and before it was set alight it was thoroughly stripped.

Even the rumor of a 40-pound bag of gold hidden "somewhere between Boston and New York," possibly on Gardiner's Island, "seems unlikely for a number of reasons. Kidd's men probably would have seen him depart with such a large bag and used the information to gain their freedom." And so forth.

Furthermore, we are told that all those swashbucklers and roarers, even the unmitigated Blackbeard himself, were merely slaves to economic forces.

"William Kidd is also a transitional figure," Ritchie announces (had he called Kidd that to his face he would have walked the plank). "The very success and geographic expansion of piracy in the 17th century could not continue in an era of thriving imperial trade. The roistering buccaneer did not suit the hard-headed merchants and imperial bureaucrats, whose musty world of balance sheets and reports came into violent conflict with that of the pirates."

Ritchie's thesis is that in the early days of imperial expansion, privateers (government-commissioned sea raiders) were a useful tool for merchants faced with lawless international competition on the seas. Theoretically, they would attack only ships belonging to hostile nations on a no-prey-no-pay basis. Governments and rich private patrons would back them and give them legal protection.

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profits, many turned pirate, attacking any likely target they could find.

The increasingly well-organized merchant marine establishment finally found them such a nuisance that they had to be exterminated. This is what happened to Kidd, a privateer (complete with performance bond) who slipped into piracy, was hunted down by British authorities and hanged.

Ritchie tells his story with a certain detachment: 55 pages of notes and frequent historical digressions make for rather slow reading. But I also found wonderful descriptions of the daily life of a pirate and got what I suppose to be an accurate sense of the pirate's world: virtually no discipline, constant disputes, betrayals and abandonment of dissatisfied crewmen, long months of hardship followed by brief bouts of gambling and drinking terrible liquor in ugly, hot little mosquito-ridden ports.

And the odd fact: pirates at first used a red flag. The skull and crossbones originally was used for shipboard disease.

And the occasional hilarity: beached when their sails rotted away, one crew "took their captured silks and made them into sails. They might not wear as well as canvas sails, but they certainly caused a sensation when they appeared at sea as a gorgeous apparition."

Aside from the somewhat dogged style, I have to admit I was intrigued with the updated view of piracy that Ritchie presents. But Robert Louis Stevenson would have had a fit.

Michael Kernan
Washington journalist and author

Wartime Writings 1939-1944
Antoine de Saint-Exupéry
Translated from the French by
Norah Purcell
Harcourt Brace Jovanovich, $12.95

It comes almost as a relief when at the end of this book, Antoine de Saint-Exupéry vanishes on July 31, 1944, apparently brought down by German pursuers while flying a photoreconnaissance mission over his native France. His last letters show the pilot-novelist to be ailing and in pain from a vertebra fractured in a household fall. More, they reveal a warrior desperate for action, a philosopher profoundly out of sync with his fellowmen, a married ascetic who said he might enter a monastery after the war if only he had the requisite faith.

Born in 1900, Saint-Exupéry was a pioneer aviator during the years of the

airplane's first commercial applications after World War I. Based on his experiences as a mail pilot, his novella *Night Flight* enshrines the lonely fulfillment of one's duty to others as the pinnacle of human endeavor. A later nonfiction work, *Wind, Sand and Stars*, more unabashedly chronicles his adventures. It contains the famous account of how he saved himself from dying of thirst after making a forced landing in the Libyan desert: he spread out his parachutes and swallowed the dew that collected.

This welcome volume, which interesperses letters and occasional journalism with glimpses of "Saint-Ex" committed to paper by those who knew or saw him (including a German sentry who may have watched his plane flop into the Mediterranean), opens with a throwback to the author's airborne salad days. In 1940, landing a plane in pre-Occupation France, Saint-Exupéry noticed that the runway lights had disappeared, indicating an obstacle on the ground (a truck, as it turned out). Instead of pulling on the stick, a maneuver that would have lifted the plane but maybe not high or soon enough, he pushed it forward. "The plane nose-dived," wrote a witness, "its wheels hitting the ground hard, and it rebounded over the obstacle, while the pilot revved the engine to gain altitude and circle the field once more."

But after this phenomenal start, Saint-Exupéry's wartime career founders. He exits from Occupied France on the same boat with the great film director Jean Renoir. In the United States he vents his disgust with assembly-line consumerism and the government's early refusal to enter the war. Profoundly antifascist, he declines to join the Gaullists because he discerns dictatorial tendencies in de Gaulle. He writes *Flight to Arras*, in part an apologia for France's capitulation to the Nazis, and *The Little Prince*, the children's fable for which he is best known.

Mostly, however, he chafes and yearns. The chafing is over his place on the sidelines: in his early 40s, he is thought too old to fly. The yearning is religious—for some "essential common denominator that I cannot perceive." At last he goes to Algiers and through string pulling gets himself attached to Col. Elliott Roosevelt's photorecon group.

Jean Renoir entitled his memoir of Saint-Exupéry "He Talked All Night Long," and one can see why he needed to explain himself at such length. Saint-Ex was a bundle of contrarieties: a jittery man of action who could sit still and work over a sentence 30 times until he got it right; a champion of freedom who extolled the regimen of the monastery, "where men have a choice between different impulses chosen from the richness of their inner life."

Above all he seems anomalous in the way he transcended his time yet remained so much a part of it. Though at odds with materialism, he idealized the pilot's relationship with his airplane. Though eager for the touch of infinity, he could not make a Kierkegaardian leap of faith. In a late letter he wrote something that both presages his violent death and epitomizes his appealing perverseness: "I might perhaps be at peace if I were the most unhappy one of all. That is why, strangely enough, my vertebra reassures me a little. And I know that if I were in great pain, I should be completely at peace."

Dennis Drabelle
Washington writer

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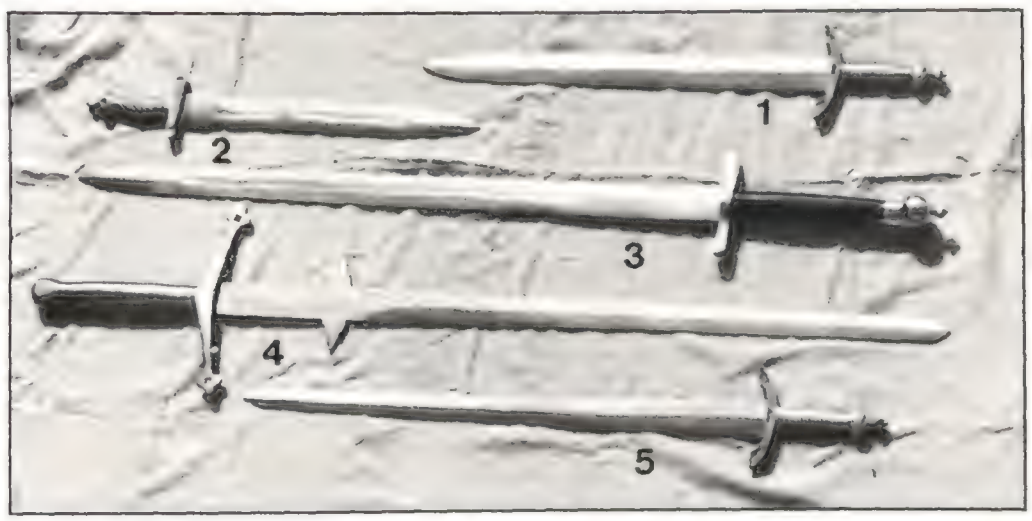

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Additional reading

Smithsonian horizons (p.12)

Second Self: Computers and the Human Spirit by Sherry Turkle, Simon & Schuster, 1984

Communication and Noncommunication by Cephalopods by Martin Moynihan, Indiana University Press, 1985

"The Locale Map of Honey Bees: Do Insects Have Cognitive Maps?" by James L. Gould, *Science*, May 16, 1986

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"Aircraft Safety: Cracks Begin to Show in the System" by Richard E. Meyer and Ralph Vartabedian, *Los Angeles Times*, March 30, 1986

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"Inspectors Find Compliance with Safety Standards Lacking" by James Ott, *Aviation Week & Space Technology*, January 13, 1986

Salvador Dali (p. 62)

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Salvador Dali: The Work, The Man by Robert Descharnes, Abrams, 1984

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Dark Caves, Bright Visions: Life in Ice Age Europe by Randall White (exhibition catalog), American Museum of Natural History, October 1, 1986

The Creative Explosion by John E. Pfeiffer, Harper & Row, 1982

In Pursuit of the Past: Decoding the Archaeological Record by Lewis R. Binford, Thames and Hudson, 1983

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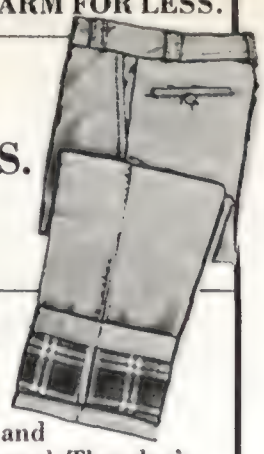

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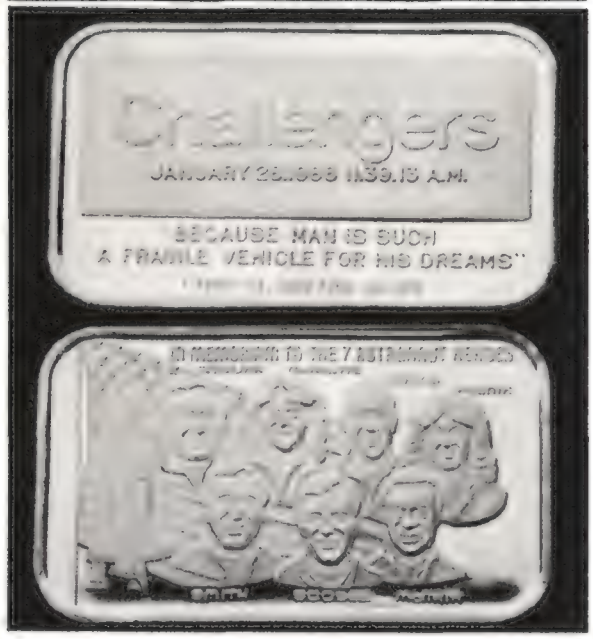

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Alaska herring (p. 96)

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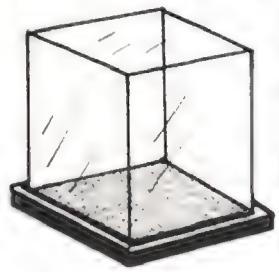

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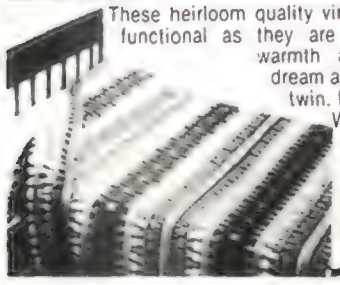

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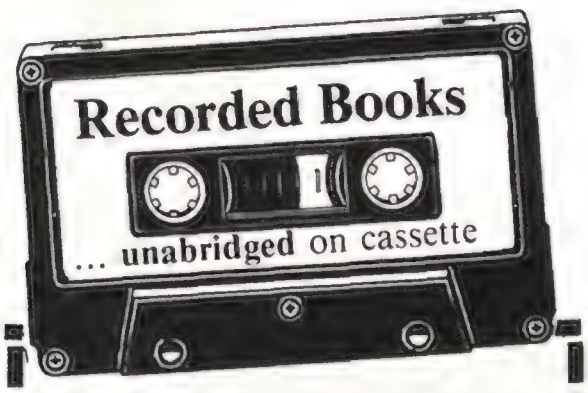

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Special October exhibits and events

Freer Gallery of Art
From Concept to Context: Approaches to Asian and Islamic Calligraphy (through November 16) See *Highlights continued.*

National Portrait Gallery
Through Light and Shadow: Photographs by Clara Sipprell (through November 30).

National Museum of American History
New and Different: Home Interiors in 18th-Century America (through July 1987) Some 60 objects including furniture, silver, ceramics, other decorative arts.

Hirshhorn Museum & Sculpture Garden
Selections from the Joseph H. Hirshhorn Bequest (through November 16).

National Museum of American Art
James Rosenquist: Paintings 1961-1985 (October 23-January 11, 1987).
Unknown Territory: Photographs by Ray K. Metzker (through November 23).

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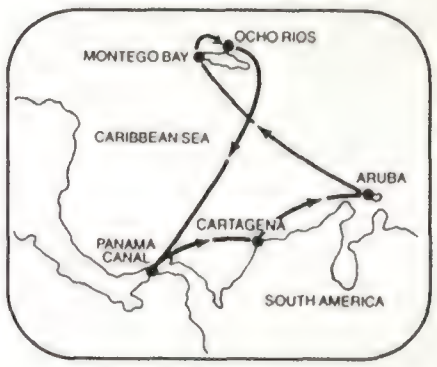

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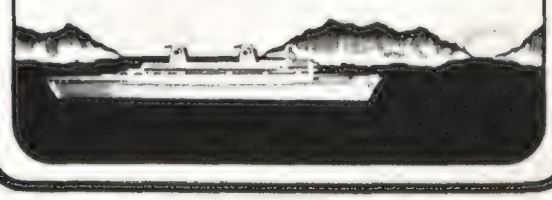

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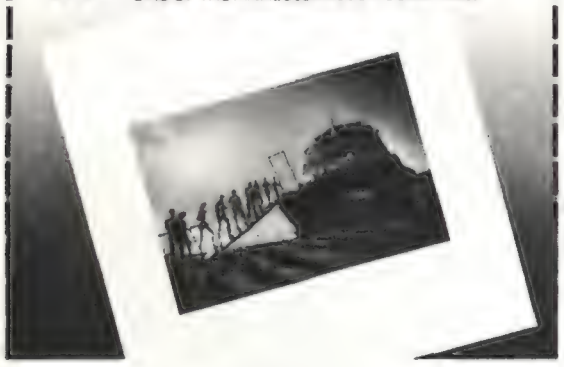

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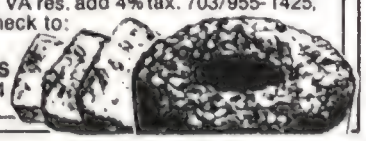

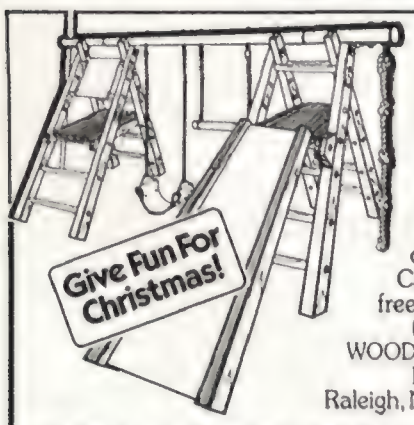

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National Air and Space Museum
Count Gianni Caproni (opens October 10) New exhibit includes Italy's first passenger and military aircraft.
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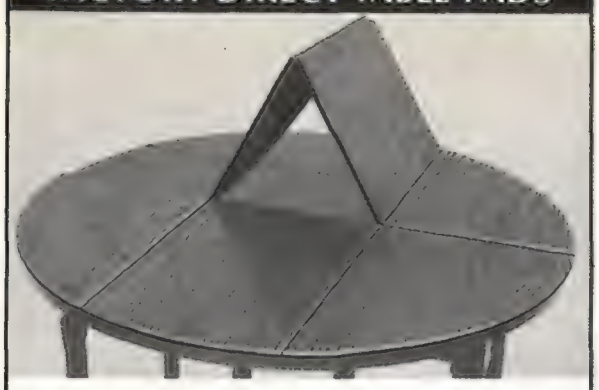

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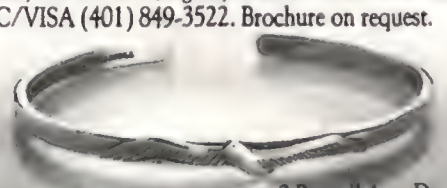

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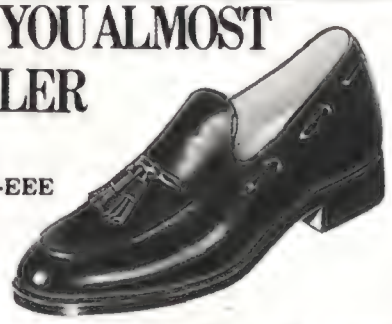

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International Poetry Forum Series, Program #1: Czeslaw Milosz (October 5; 7:30 P.M.) Nobel Prize-winner reads his works.

Gold and Silver: The Royal Danish Collection (October 8; 8 P.M.) Slide-illustrated lecture by Ole Villumsen Krog.

Building America: What Are the Ground Rules? (October 14; 6:30 P.M.) Symposium with planners and builders.

Cinema from the Soviet Republics (Six Wednesday evenings beginning October 15; 8 P.M.) Selections from the 1986 Tashkent Film Festival.

1986-87 Jazz Series, Program #1: Almost Forgotten Ellington (October 19; 7:30 P.M.) Pianist Mark Tucker, singer Ronnie Wells, ensemble led by Doug Richards.

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Clearwater, Florida (October 27-December 7) *John Held's America: Flappers, the Jazz Age and Beyond*, Ruth Eckard Hall.

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Highlights continued

Celebration of calligraphy

In the traditions of East Asia and Islam, the written word is embellished—but it still always must be readable

Many people in the Western world have difficulty understanding the special status of calligraphy in Asia and the Middle East. Here, we usually think of paintings or sculptures as our masterpieces.

For the East Asians and Muslims, however, calligraphy has more status than any other art form, although the reasons are quite different. For the Chinese and Japanese, the written word is virtually a window on the soul of the communicator—a reflection not merely of skill but rather of the very character and cultivation of the person wielding the brush. For the Muslims, on the other hand, the written word is an instrument of God's will. The result in both cases is a rich artistic tradition.

The Freer Gallery of Art has brought together its most outstanding examples of calligraphy—55 works in all including scrolls, poems, inscriptions, manuscripts and metalwork—for its current exhibition, which is entitled "From Concept to Context: Approaches to Asian and Islamic Calligraphy." An exquisite scholarly catalog accompanies the show.

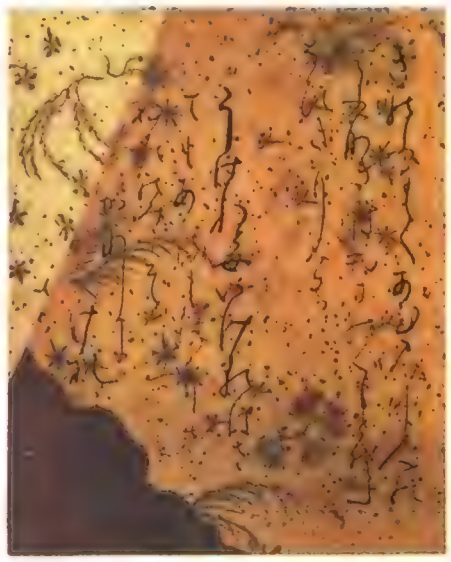
The range and beauty of the works on exhibit is extraordinary. Of the four shown here, one is Islamic, and the other three are from Japan. The Islamic calligraphic page (upper left), with its sloping *nastaliq* script, comes from an album believed to have been assembled for the 17th-century Mughal emperor Shah Jahan. At the upper right, a bronze Buddhist altar pendant from Japan has on each side two single Sanskrit characters, each of which probably represents a deity. The other two works are a leaf from a 12th-century volume of poems and, below, a lacquered-wood inkstone case depicting a poem-picture on its cover.

Varied as these works are, they all share one quality. No matter how elaborate they became, it was still required that they be readable. Many of us in the West cannot even claim that quality in our everyday jottings.

Constance Bond

Calligraphic page was in album that may have been assembled for Mughal emperor.

A Buddhist altar pendant has Sanskrit characters.



Poetry in *hiragana* script is Japanese, from 12th century.

Three syllables of script are concealed in the rocks (foreground) of an inkstone case.

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Hawaii February 7-19, February 21-March 5: Experience undersea wonders of Oahu's Hanauma Bay, great volcanoes of the big island, lush forests and tropical birds of Kauai and whale watching off Maui.

Baja Whale Watch February 23-March 3 or March 3-11: Explore beauty of Baja California in company of gentle gray whales.

Cajun Country April 5-13: Experience Louisiana—New Orleans jazz, Creole cooking, mysteries of the bayou.

Arizona in Spring April 12-20 or 22-30: Tour the Sonoran Desert and Chiricahua Mountains to see many species of unique Southwestern wildlife.

Big Bend April 14-23: Hike the spectacular canyon trails in this southwestern Texas wilderness park.

Delta Queen April 16-23: Take a steamboat journey to America's past on the lower Mississippi from New Orleans to Memphis.

New York May 14-17: Enjoy a weekend of architectural walking tours, elegant dining, Broadway theater and museum visits in the Big Apple.

Coming in June Cultural tours of Chicago and Montreal.

Foreign Study Tours

Atlantic Crossing November 29-December 14: A sailing adventure with lectures—from the Canary Islands to Martinique on the four-masted *Sea Cloud.*

Christmas in Europe Celebrate with fellow Associates in one of four idyllic settings: Munich and Rothenburg; Winchester; Salzburg and Vienna; or Canterbury.

Backstage London January 2-11: In Europe's theater capital, attend traditional and avant-garde productions, meet company members backstage.

Tanzania-Kenya Wildlife Safari January 23-February 11: A unique wildlife excursion featuring the best of East Africa.

South America January 23-February 17: Three-week land and sea voyage from Rio de Janeiro, including Iguaçú Falls, Strait of Magellan and other Patagonian channels.

Russia—Performing Arts January 31-February 14: Presenting the best of Russian theater, opera, dance and music in Moscow and Leningrad.

A Hike in New Zealand February 9-25: From Lake Te Anau to Milford Sound, discover wildflowers, crystalline lakes and snowcapped peaks on the Milford Track.

Yucatán Adventure February 12-24: Explore extraordinary Maya ruins in the company of a pre-Columbian archaeologist.

Costa Rica February 21-March 6: An expedition for nature enthusiasts to see flora, birds and wildlife in the American tropics.

Voyage to the Islands of the South Pacific February 21-March 10: Aboard the *Illiria*, travel from New Guinea to Fiji through three great island groups. Observe diverse cultures and traditional art; enjoy striking natural beauty.

Zapotec and Maya Mexico February 26-March 10: Traveling from the central highlands to the Yucatán Peninsula, discover ancient ruins of Palenque and Uxmal and the colonial cities of Oaxaca and San Cristóbal de las Casas.

Australia-New Zealand March 1-24: An intriguing introduction to the natural history and cultural heritage of the lands "down under"—from the vast "red center" of the oldest continent on Earth to the magnificence of New Zealand's Southern Alps.

The Valley of Mexico and El Tajín March 13-25: Sample rich, diverse cultures in and around Mexico City and Veracruz.

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Natural Science Illustration
Learn the fine techniques of natural science illustration during hands-on workshops with Smithsonian illustrators, meet acclaimed artist Robert Bateman and preview "Portraits of Nature," a major exhibition of Bateman's paintings at the Museum of Natural History.

Presidential Washington
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By Nancy Seaman

In the big city, it's notes to you—and you

"This strange-looking doghouse has sentimental value only. Property of #405. I will store in my bin as soon as I get rid of some of the firewood and can make room for it. Contact me if this is in anyone's way." So read the note pinned to a small pagoda-like structure occupying about nine square feet of floor space in my condo's basement. A conciliatory message; the infraction of house rules wasn't that serious, and as soon as the weather turned cold. . . .

By contrast, these words, tacked to the door of a nearby building: "Did you leave your key with Robert or tell him what arrangement you made to let the exterminator into your apartment? We MUST cooperate to get rid of the roaches!"

So different in tone, these two citizen-to-citizen communications drew my eye soon after I moved to the District of Columbia. I had been a four-wheeled suburbanite familiar with telephone-pole publicity: PTA meetings, yard sales and senior-class car washes. And I shared the view of big cities as impersonal places largely inhabited by graffiti artists and hostile folk whose faces twitch as they walk. What I found as a downtown pedestrian was that this modern metropolis seethes with literate middle-grounders who have all sorts of things on their minds that they openly express *in handwritten prose.*

For ten years I've been collecting and indexing samples of an urban literature that sociologists no doubt will one day classify as CitiRite. Quantitatively, the categories *Law & Order, Auto* and *Animals, Lost* are tied for first place. Then come *Announcements & Requests, Public* followed by *A&R, Private. Complaints,* surprisingly, finish a poor last.

Law & Order, Auto are mostly brief and banal—ho-hum reading on the beat. "Officer, Please don't ticket. I'm getting my parking sticker today." "This meter took my money and it got stuck. Please report it." "Vehicle not in running condition—be back to tow it away." Occasionally a motorist opens the door on a real automotive slough of despond: "Officer Brandenburg et al., A new axle boot is on order at Midtown Motors but it will take several weeks. I would appreciate it if you would refrain from ticketing . . . as there is obviously no more I can do until the new part arrives."

For sheer complexity, though, my favorite is the driver who taped a scruffy-looking Zone 1 parking sticker on the inside lower-left corner of his (her?) windshield, with matching rationale: "The reason this sticker is torn is that I originally fastened it to the lower-right corner . . . where it wouldn't obstruct my vision, but police gave me a ticket for illegal parking anyway. In removing the sticker to place it in the lower-left corner *by the curb* (where it blocks my view) it tore. Please do not ticket me again."

Among *Animals, Lost,* cat items predominate. They tend to echo the one about Clyde, of "adventurous spirit and outgoing personality," who has not come home since May 4 and who, besides being "intelligent, was not wearing his collar." Clyde's distraught owner should meet the sufferer from an "extreme allergy" who, under doctor's orders to get rid of an Abyssinian, offered to sacrifice it for "only $1,000 per oz. or FREE to a good home." A no-nonsense *Lost* note opens with a "$500 cash reward for return of African gray parrot . . . needs immediate medical care and to be reunited with mate or both will die."

Within *Announcements & Requests, Public,* tempting is the "fully guaranteed" promise that "you can learn to sing beautifully in a very short time"—by calling a local number. Many are signs of changing times: "Woman needed to share 3 bedroom (1½ bath) house W/2 amiable males in mid-20s. . . . W/D. No tobacco, no slobs, no pets (we have a dog). Feminist heartily welcome." One pub heaved a corporate sigh: "Closed for repairs Monday Only. Sorry for the inconvenience. [Signed] Joe, Sue and Staff. P.S. We needed the day for mental health."

As for *A&R, Private,* the Fortune Cookie 500 Award for honesty goes to the Chinese restaurant that confessed in its window: "Ms. Hewitt, We owe you $5." And for sheer abjectivity (in a high-rise lobby): "Please forgive me for losing my head and my pee in the hallway. My Mama says she'll get on her hands & knees and Woolite & scrub. Perhaps we can blame it on my extreme youth. [Signed] Whimper! Wriggle! Arf! Arf!"—plus pawprint. For directness (clipped to the kaput house phone in a low-rise entry): "C.J., Just go outside and yell. [Signed] Kathy."

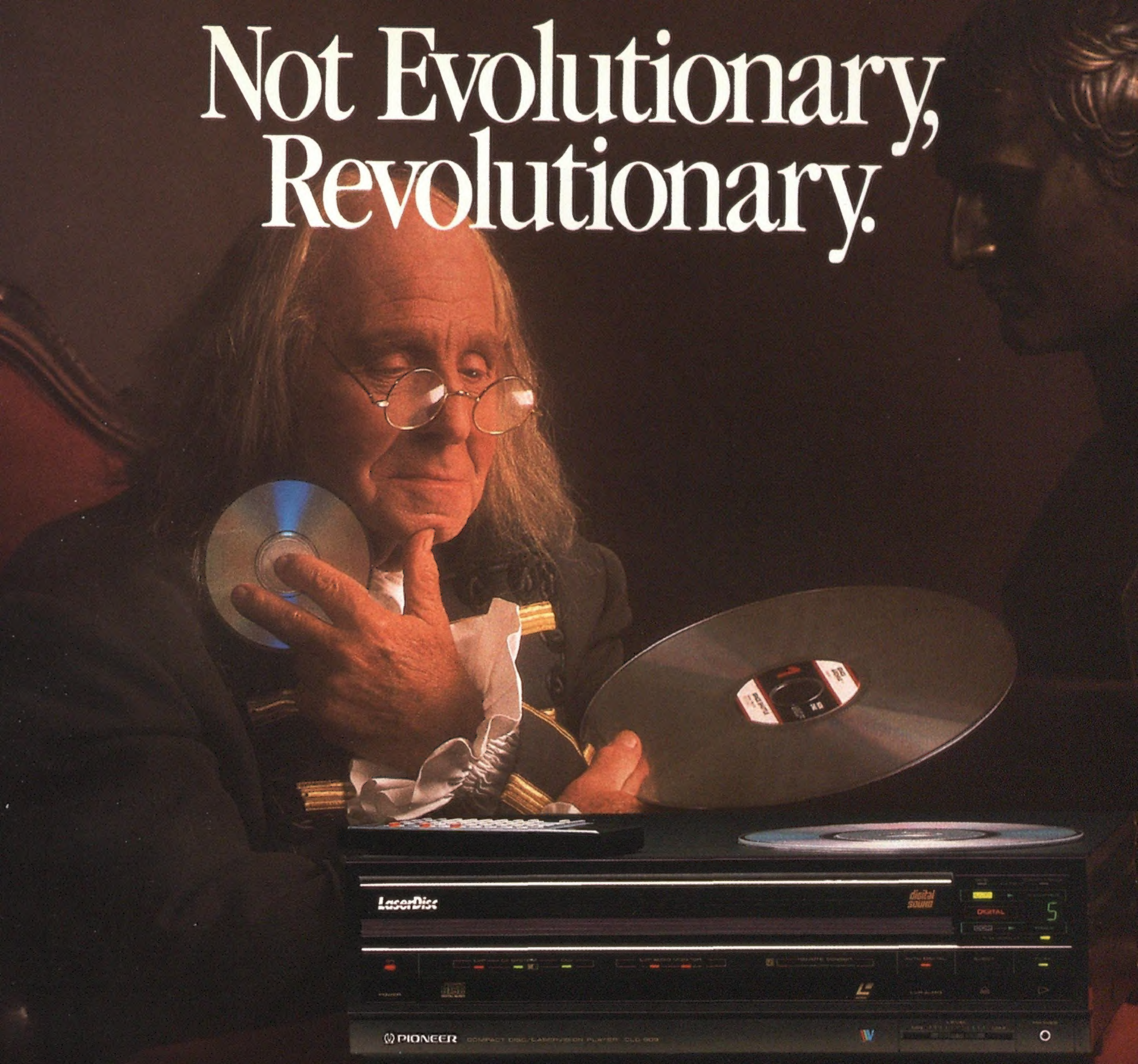
CitiRiters tend to be long-suffering; only grave offenses elicit *Complaints*: "I got this card so I could get money when I need it—like NOW!" a frustrated bank customer scrawled on an automatic-teller envelope. A didactic town-house tenant used twist ties to affix this lesson to an iron banister: "Neighbor, There are two apartments served by these stairs. By blocking them with your trash, you are endangering the lives of the innocent."

I know I'm onto something because only yesterday I found a piece of pure CitiRite wedged in my own windshield: "You are parked in the middle of two spaces. Why?" As if to help with the reply, the ultimate *Announcement* appeared on a wall in the ladies' room near my office:

GOD'S PHONE NUMBER IS
JEREMIAH 33:3

I checked it out. The message read: "Call unto me, and I will answer thee, and show thee great and mighty things, which thou knowest not."

Not Evolutionary, Revolutionary.



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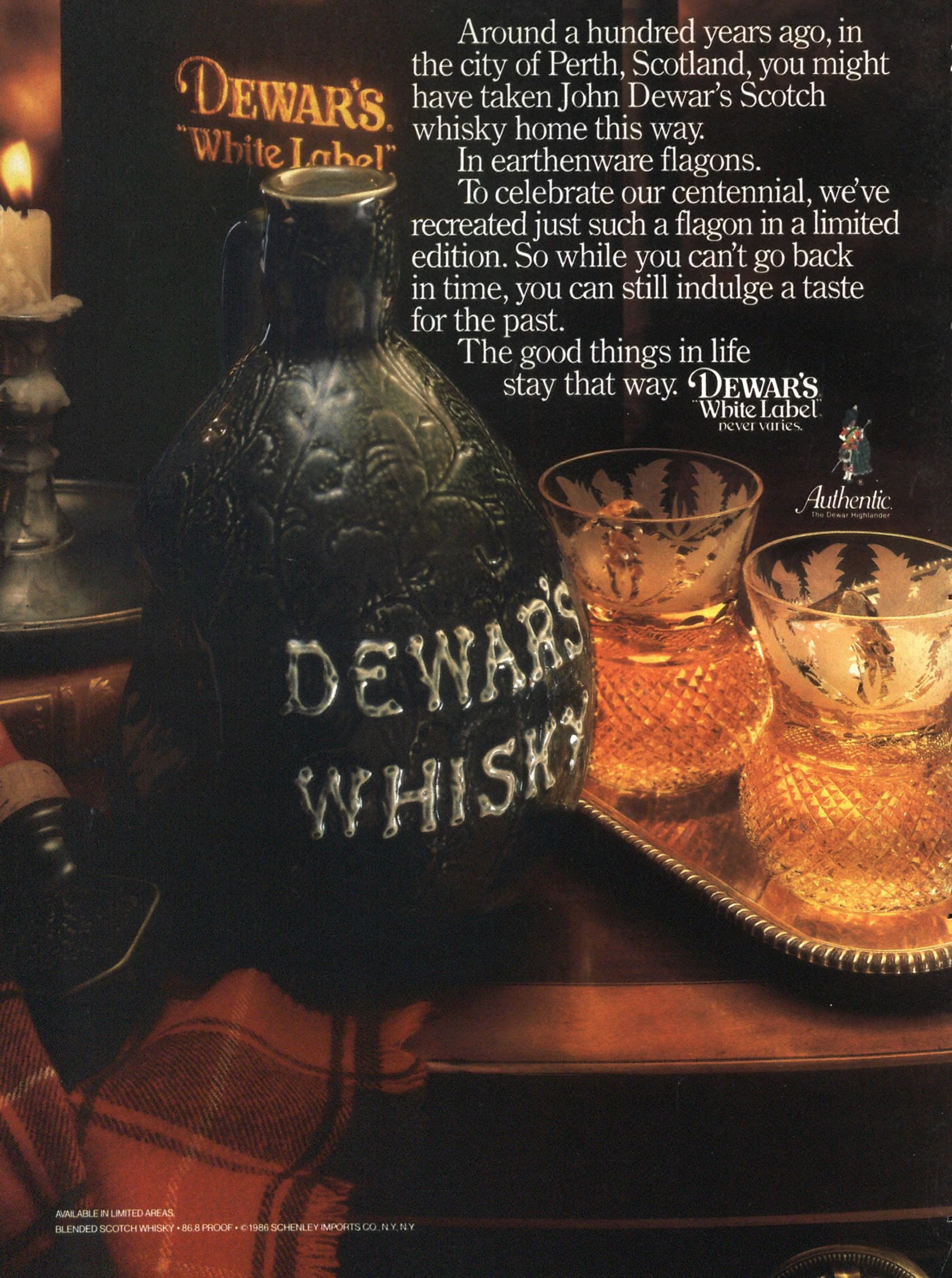

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